Aalto University
School of Business

DOES ADDING A SHORT PORTFOLIO ENHANCE THE PERFORMANCE OF DISTRESS-RISK-ELIMINATED VALUE STRATEGY?

Evidence from the European stock markets

Master's Thesis
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Abstract of master's thesis

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PURPOSE OF THE STUDY

The main purpose of this paper is to study whether it is possible to find distressed glamour stocks from the market, and whether these stocks underperform other glamour. Furthermore the paper studies if it is possible to enhance the returns of a value strategy by being long non-distressed value stocks and short this distressed glamour. The study utilizes Altman Z-score (Altman, 1968 and 2000) and credit rating as measures for distress risk, and compares whether the results look similar between these measures. The paper is based on two competing theories for the value anomaly: Fama and French (1993) risk-factor theory stating that value strategy returns are due to higher distress of value stocks and Lakonishok, Shleifer and Vishny (1994) mispricing theory stating that investor sentiment overprices glamour and underprices value stocks.

DATA

The data set used is for EuroStoxx600 stocks for a time period from 2009 to 2018. Data for single stocks as well as the EuroStoxx600 index total return is retrieved from Thomson Reuters. The factor portfolio data as well as the risk-free rate is from Kenneth French data library.

RESULTS

The most important results are that 1. It is possible to find distressed glamour stocks in the market, 2. These distressed glamour stocks underperform other glamour and 3. A distress risk eliminated long/short value strategy performs well even when traditional factor portfolios don't. These results imply that distress risk is priced incorrectly in glamour stocks, and utilizing this mispricing, it is possible to beat the traditional value portfolios.

Consistent with Piotroski (2000) and Griffin and Lemmon (2002) the study finds that distress risk elimination increases the returns of a value strategy. Piotroski finds that distress risk eliminated value long portfolio return is 7.4% higher than the plain value portfolio return annually, whereas this paper concludes that the distress risk eliminated long portfolio returns stay similar, but the standard deviation decreases comparing with plain value. Griffin and Lemmon find that non-distressed value long portfolio provides 2.3% annual alphas after controlling for FF3 factors. This paper finds significant annual alphas of 4-5% and it seems that most of this alpha is due to the newly introduced short leg of distressed glamour stocks, since the annual raw return of the distressed glamour portfolio is only 12.4% compared to the plain glamour portfolio 19.1%. Furthermore the distress risk eliminated long/short portfolio beats the plain value long/short portfolio by raw returns (6.0% vs. 3.5% annually) and Sharpe ratios (1.06 vs. 0.39). The study finds that on average 11% of glamour stocks can be considered quite distressed, whereas 13% of value stocks can be considered very robust. This result indicates that the possibility to find distressed glamour is similar than finding non-distressed value. Furthermore the results show that value stocks are more likely to be distressed than glamour (34% vs. 11% distressed) and that the distressed glamour is in fact a better short portfolio compared to non-distressed glamour, since the long/short portfolio return is higher (6.0% vs. 2.7%) and less volatile (5.7% vs. 6.3%) with the distressed short leg.

On the other hand the study finds that the distress risk eliminated long/short portfolio performance persists even when traditional factor portfolios suffer from decreasing returns. Lastly, it seems that monthly rebalancing adds value to the distress risk eliminated value strategy in comparison with less frequent trading.

Keywords Credit rating, Altman Z, Value strategy, Distress risk

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Abstract of master's thesis

Tekijä Juho Kiiski

Työn nimi Parantaako shorttiportfolion lisääminen konkurssiriskikontrolloidun arvostrategian tuottoja?

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TUTKIMUKSEN TARKOITUS

Tämän tutkimuksen tarkoitus on tutkia löytyykö markkinoilta konkurssiriskisiä kasvuosakkeita, ja häviävätkö nämä osakkeet muille kasvuosakkeille. Lisäksi tutkimus tarkastelee voiko arvostrategian tuottoja parantaa ottamalla long-positio konkurssiriskittömiin arvo-osakkeisiin ja short-positio näihin riskisiin kasvuosakkeisiin. Tutkimus käyttää Altman Z-lukua sekä luottoluokitusta konkurssiriskin mittareina ja vertailee ovatko tulokset samankaltaisia näiden mittarien välillä. Tutkimus perustuu kahteen kilpailevaan teoriaan arvoanomalialle: Faman ja Frenchin (1993) riskifaktoriteoriaan (arvosijoitusstrategian korkeat tuotot johtuvat arvo-osakkeiden korkeasta konkurssiriskistä), sekä Lakonishokin, Shleiferin ja Vishnyn (1994) väärinhinnoitteluteoriaan, jonka mukaan sijoittajat alihinnoittelevat arvo-osakkeita ja ylihinnoittelevat kasvuosakkeita.

DATA

Käytetty data on EuroStoxx600 osakkeista vuosilta 2009 – 2018. Data yksittäisistä osakkeista ja EuroStoxx600-indeksistä on kerätty Thomson Reutersilta. Faktoriportfoliodata sekä riskitön korko ovat Kenneth Frenchin datakirjastosta.

TULOKSET

Tärkeimmät tulokset ovat, että 1. Markkinoilta on mahdollista löytää riskisiä kasvuosakkeita, 2. Nämä osakkeet tuottavat huonommin kuin muut kasvuosakkeet ja 3. Konkurssiriskieliminoitu long/short-arvoportfolio tuottaa hyvin myös aikoina jolloin faktoriportfoliot eivät. Nämä tulokset osoittavat, että konkurssiriski on hinnoiteltu väärin kasvuosakkeisiin ja väärinhinnoittelua hyväksikäyttämällä on mahdollista voittaa perinteinen arvoportfolio.

Kuten Piotroski (2000) sekä Griffin ja Lemmon (2002), tämä tutkimus löytää että konkurssiriskin eliminointi parantaa arvosijoitusstrategian tuottoja. Piotroski löytää, että konkurssiriskieliminoitu arvoportfolio voittaa kontrolloimattoman portfolion 7.4% vuosittain, kun taas tämän tutkimuksen mukaan arvoportfolion tuotot pysyvät samankaltaisina, mutta volatiliteetti laskee kun konkurssiriski eliminoidaan. Griffin ja Lemmon löytävät, että matalan konkurssiriskin arvo-osakkeet tuottavat 2.3% vuotuista ylituottoa FF3-faktoreilla kontrolloinnin jälkeen. Tämä tutkimus löytää 4-5% vuosittaisen ylituoton, joka vaikuttaa johtuvan uutena esitellystä short-portfoliosta konkurssiriskisiä kasvuosakkeita, sillä tämän short-portfolion raakatuotto on ainoastaan 12.4% vuodessa verrattuna puhtaan kasvuosakeportfolion tuottoon 19.1%. Tutkimus löytää, että keskimäärin 11% kasvuosakkeista on konkurssiriskisiä, kun taas 13% arvo-osakkeista ovat hyvin riskittömiä. Tämä tulos indikoi, että konkurssiriskisiä kasvuosakkeita on yhtä todennäköistä löytää kuin riskittömiä arvo-osakkeita. Lisäksi tulokset osoittavat, että arvo-osakkeet ovat todennäköisemmin konkurssiriskisiä kuin kasvuosakkeet (34% vs. 11% osakkeista konkurssiriskisiä) ja että tämä konkurssiriskinen kasvuosakeportfolio toimii short-portfoliona paremmin kuin riskitön kasvuportfolio, sillä long/short-portfolion tuotot ovat korkeammat (6% vs. 3%) ja volatiliteetti matalampi (5.7% vs. 6.3%) tämän konkurssiriskisen short-portfolion kanssa.

Tutkimus löytää lisäksi, että että konkurssiriskieliminoidun long/short-arvoportfolion tuotot pysyvät korkeina vaikka perinteisten faktoriportfolioiden tuotot laskevat. Vaikuttaa myös siltä, että kuukausittainen portfolion uudelleenmuodostus tuottaa arvoa strategiaan verrattuna harvempaan uudelleenmuodostukseen sekä raakatuotoin, Sharpen luvuin, että ylituotoin mitattuna.

Avainsanat Luottoluokitus, Altman Z, Arvosijoitusstrategia, Konkurssiriski

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1 INTRODUCTION

1.1 Background

In academia, people have been interested in the value anomaly for a very long time. Introducing value as a factor that has an effect on stock returns was done by Fama and French on 1993, and since then the HML (High-Minus-Low) portfolio has been a benchmark or a factor in most of the papers discussing any equity portfolio returns. This HML portfolio is constructed as long positions in value stocks screened by high book-to-market (or low market-to-book) ratios, and short positions in growth or glamour stocks screened by low book-to-market ratios. Fama and French (1993) as well as others also suggest other metrics in constructing the value factor portfolio, such as Price-to-Earnings ratio for example. However, they find that the book-to-market ratio is the most robust metric in determining the value factor portfolio.

Later it has been discussed whether HML is a risk factor (as stated by Fama and French (1993, 1995, 1996), or whether it just explains outperformance of given portfolios without increasing risk (for example Lakonishok, Shleifer and Vishny, 1994 and Petkova and Zhang, 2005). The risk factor argument is justified by stating that value stocks have higher default risk than growth, or glamour, stocks. On the other hand, the argument from the mispricing side is that investor sentiment drives value stock prices too low and glamour stock prices too high. Here is where this paper steps in: It argues that some stocks in the value factor portfolio have higher distress risk (in this paper measured by Altman Z and Issuer rating), and therefore their valuation is justified by risk, but the portfolio also includes stocks that are genuinely undervalued due to investor sentiment. This means that eliminating distress risk for the companies in the value factor portfolio could increase the outperformance of the value investing strategy. Further this gives reason to also consider distress risk as a factor of its own, and to try to determine whether all the return of a distress risk eliminated long/short value portfolio[1] (specified as long positions in non-distressed value stocks with low P/B and high Z-score and short positions in distressed glamour stocks with high P/B and low Z-score) is explained by distress risk and other selected factor portfolios.

Distress risk and the possible distress anomaly are also quite well discussed in academia. For example papers from Campbell, Hilscher and Szilagyi (2008) find that distressed stocks have

[1] The baseline distress risk eliminated long/short value portfolio is long bottom 20 P/B stocks with Z-score over 5 and short top 20 P/B stocks with Z-score below 2.3. Amount of 20 stocks is 5% of all stocks in sample.

underperformed in the market, and that these stocks load heavily on the market, SMB and HML factor portfolios. This argues in favour of eliminating credit risk when creating value investing strategies. On the other hand, Anginer and Yildizhan (2017) report that they find high returns for distressed firms that are largely explained by the market factor, but even with risk-adjustments the returns of these risky companies don't underperform the market. Furthermore Altman (1968, 2000) creates and later calibrates a model (and a key figure, Altman Z) predicting the default risk of a company that includes the following five variables: Working capital/Total assets, Retained earnings/Total assets, Earnings before interest and taxes/Total assets, Market value of equity/Book value of total liabilities and Sales/Total assets. All of these factors have positive coefficients in the model, and therefore higher numerators and lower denominators mean higher Altman Z-score that further implies lower default probability. The paper utilizes the Z-score as one way of measuring the credit risk of the firms in the portfolio selection. It is recognised that the Altman model includes the market value of equity in one of its determining variables, so there will be some negative correlation between the value factor and distress risk selection (based on P/B figure and Z-score). However, we shouldn't see this as a major concern, since the market value of equity is just a minor part of conducting the Z-score. Furthermore, the paper utilizes Issuer credit rating as another distress risk proxy to compare between different distress measures as well as to double-check the robustness of the results. For example Nickell, Perraudin and Varotto (2001) compare the performance of ratings and equity-based (Altman Z) credit risk models and conclude that they perform quite equally in determining default probabilities. Therefore they should be expected to work quite equally in measuring distress risk in this analysis as well.

1.2 Contribution

The most important contribution of this paper is to study whether it is possible to find distressed glamour stocks[2], stocks with high P/B and low Altman Z, from the market and whether these stocks underperform other glamour. Previously it has been shown (by for example Griffin and Lemmon, 2002) that distress risk is incorrectly priced in value stocks, and this research contributes by studying whether this risk is priced incorrectly in glamour stocks as well.

In more detail the paper considers whether eliminating distress (or credit) risk enhances the traditional value strategy. The distressed glamour stocks are included in this strategy as the short leg to create a distress risk eliminated value long/short portfolio to compare against

[2] Baseline distressed glamour stocks screened with top 5% P/B stocks with Z-score below 2.3.

traditional factor portfolios. Moreover the paper studies if the potential outperformance of the distress risk eliminated value portfolio is completely explained by a distress risk factor and other selected factors. This further contributes to the discussion on whether the value stock outperformance is completely due to higher riskiness of these stocks (Fama and French, 1993), or also (partly or fully) due to investor sentiment and real mispricing of stocks (Lakonishok, Shleifer and Vishny, 1994).

It has been studied previously whether higher distress risk leads to under- or overperformance and whether the high distress risk portfolios load on the value factor (for example Campbell, Hilscher and Szilagyi, 2008). There has also been some research on whether eliminating distress risk enhances value strategy, but this research has been about long portfolios and mostly about their raw returns. Furthermore in previous literature the rigorousness of the distress risk cutoff varies in time, which might not be a wanted characteristic for the portfolio (for example Griffin and Lemmon, 2002) and it hasn't been studied on whether the plain value portfolio return loads on distressed stock returns. Lastly, the studies have been conducted mostly for US stocks with yearly portfolio rebalancing, and the studies mainly utilize data from before year 2000.

This study introduces a potential short leg of distressed glamour stocks to create a long/short portfolio around distress risk eliminated value and see whether the short side contributes positively to the overall strategy. The study further introduces a distress risk factor portfolio[3], a long/short portfolio with long positions in high Z-score stocks and short positions in low Z-score stocks, to see whether the value portfolios load on these distress returns. Furthermore the paper applies a constant distress risk cutoff in time, and utilizes recent European data as well as considers shorter holding periods than previous studies have.

The closest to this research is perhaps Piotroski (2000) who studies whether financial statement analysis can enhance the returns of value strategy. However Piotroski mostly focuses his research on profitability analysis, namely if operating profitability controlling increases the return of value strategy, whereas this paper focuses on the risk decreasing side. These results are expected to be somewhat similar with each other, but since current high profitability doesn't automatically mean low distress risk, the analysis can be expected to be helpful in diminishing the role of distress risk in the value anomaly better. Furthermore Piotroski only takes a view on whether the long side of the value portfolio can be improved by this controlling, and he utilizes

[3] Distress risk factor portfolio is specified as long positions in top 5% Z-score stocks and short positions in bottom 5% Z-score stocks.

US data from before year 2000 with annual portfolio rebalancing. This paper looks whether a short side of all glamour can be improved by only choosing distressed glamour stocks as short positions as well as it studies holding periods down to 1-month with recent European data. Regarding the holding period it can be argued that at least quarterly we get enough accounting data to have incentives for new portfolio selection. Moreover, indications of value can be found in the market based on stock markets moving without any new accounting information, and reacting faster to these information could be value adding.

1.3 Key findings and limitations

The most important findings can be divided into three points:

1. It is possible to find distressed glamour stocks in the market.
2. These distressed glamour stocks are a better short leg for the non-distressed value strategy than non-distressed glamour stocks are.
3. The performance of the distress risk eliminated value long/short portfolio is high during the whole period, even when the traditional factor portfolios don't perform.

The first two points show that distress risk is not priced correctly in glamour stocks whereas the last point indicates that utilizing this incorrect pricing of distress risk, it is possible to outperform the traditional value long/short portfolios.

Further the results show that eliminating distress risk enhances the value strategy. A distress risk eliminated value long/short portfolio beats the plain value portfolio[4] (long/short portfolio long low P/B stocks and short high P/B stocks) by raw returns (6.0% vs. 3.6% annually), Sharpe ratios (1.06 vs. 0.39) and risk-adjusted returns (significant 4 – 5% vs. mostly insignificant 2 – 4%). Further the results show that on average 11% of glamour stocks can be considered quite distressed, whereas 13% of value stocks are very robust. This indicates that it is almost equally likely to find non-distressed value stocks as it is to find distressed glamour. These results are in line with Lakonishok, Shleifer and Vishny (1994) mispricing theory. On the other hand it seems that the plain value strategy loads on distressed stocks, whereas the distress risk eliminated strategy loads on non-distressed stocks (Distress risk factor loading -0.2 vs. 0.2). The results also show that 34% of value stocks can be considered quite distressed, whereas the same proportion of glamour is only 11%. These are in line with Fama and French (1993) risk-based

[4] Plain value portfolio is specified as long positions in bottom 5% P/B stocks and short in top 5% P/B stocks.

theory, since it seems that value stocks are on average more distressed than glamour. Further it seems that both the long (Sharpe 1.39 vs. 1.18) and short (Sharpe 0.95 vs. 1.09) legs are enhanced in the distress risk eliminated portfolio compared to the plain value portfolio. This implies that the short leg that hasn't been studied previously adds value to the strategy. The results also show that distressed glamour stocks create a better short leg for non-distressed value compared to non-distressed glamour, since both the long/short portfolio return increases (6.0% vs. 2.7% annually) and volatility decreases (5.7% vs. 6.3% annually) with the distressed glamour short leg.

The results further show that the strategy works in both highly (during 2009 - 2013) and moderately (during 2014 – 2018) positive return environments whereas lately the traditional factor portfolios and plain value portfolio have suffered from decreasing returns (market and SMB portfolio returns 0%, plain value -3%, distress risk eliminated value 4.2% annually during 2017 – 2018). Moreover it seems that applying shorter holding periods enhances the strategy. This can be noticed in the alphas between 4% and 5% with 1M holding periods compared to 2.5 – 4% with 12M holding, and the result implies that faster reaction to either accounting information or value indication from the market increases the outperformance of the strategy.

The data utilized is for EuroStoxx600 companies for a period of 01/2009 - 12/2018. The scope and scale of the data means that it only includes quite liquid European stocks, and so it remains for papers to come to look into whether similar results hold in other geographies and smaller stocks. Motivation for my choice of scope is that European markets have not been as studied as the ones in US, and that EuroStoxx600 includes mostly stocks that can be shorted to a meaningful extent which makes the long/short strategy implementable. This might not be the case with smaller stocks. Furthermore, my time period is mostly within an era where we have observed bull markets, and therefore it remains to be studied whether the results remain similar in bear markets as well. The reason behind the choice of time period is that the data is unreliable for longer time periods, especially for the Z-score and issuer rating.

A further limitation is that the trade-off between tightening distress risk or Price-to-Book cutoffs is not optimized, but the thresholds are merely chosen based on previous literature considering the values deemed good for the Altman Z, Credit ratings and P/B, as well as making large enough of a difference between the long and short legs of the portfolio with both value and distress risk cutoffs. The parameters are altered to consider sensitivities to changes in these value and distress risk thresholds, but they are not optimized. This optimization could add value to the strategy and make the return of the portfolio even higher, but it also might overfit the data.

1.4 Structure

At this point the background and limitations of the paper have been introduced, as well as the contribution and key findings have been discussed. Going forward, Section 2 provides the relevant literature review regarding distress risk elimination and monitoring as well as regarding the value anomaly. Lastly that section takes a closer look at the research around distress risk eliminated value strategy that comes closest to the approach utilized in this paper. In Section 3 hypotheses are introduced followed by Section 4 presenting the data and methodology in more detail. Section 5 provides the results, which are then discussed in Section 6. Section 7 concludes.

2 LITERATURE REVIEW

This section presents relevant literature regarding the approaches to the value anomaly and distress risk as well as credit/distress risk elimination, measurement and anomaly. It further discusses the research closest to the approach utilized in this paper. The section starts with the approaches to the value anomaly and distress risk, and then moves on to the measures and proxies of credit risk. After this the distress risk anomaly is discussed while the last part focuses on the research closest to the approach utilized in this paper.

2.1 Review of value anomaly and distress risk

As shortly mentioned already in the introduction, the value anomaly has been studied a lot in the past. On the general level we can divide the discussion of the reasons behind the value anomaly to two main categories: The risk-factor based approach, which states that the value anomaly is due to higher (credit/distress) risk in value stocks when comparing to growth or glamour stocks (for example Fama and French, 1993) and the mispricing approach, which believes that the anomaly is due to investor sentiment overpricing glamour stocks and underpricing value stocks (for example Lakonishok, Shleifer and Vishny, 1994). This subsection discusses the main literature and findings related to these two theories.

Fama and French (1993, 1995, 1996) risk-factor explanation for the value anomaly is in fact based on the Merton model (1974) which states that the asset's price should only depend on its riskiness. In addition to Fama and French (1993), Friewald, Wagner and Zechner (2014), Chan and Chen (1991) as well as Malik and Aftab (2013) find results supporting this risk-based explanation. Friewald, Wagner and Zechner (2014) find that stock returns increase with credit spreads. Furthermore they report that the credit spreads (and therefore distress risk) explain quite well the returns of the size and value anomalies. Also Chan and Chen (1991) find evidence supporting the Merton model. They find that the small company portfolio contains a large portion of distressed stocks proxied by low operational efficiency and high leverage. Furthermore they find that low production efficiency and high financial leverage explain the return of size anomaly portfolios quite well. Lastly to create a geographic dimension, Malik and Aftab (2013) find that in the Pakistani stock market, distressed companies tend to outperform healthy firms. They have utilized the Altman Z in proxying distress risk. However, this last result is not risk-adjusted, and has no statistical significance, as well as it doesn't take a particular view to the value anomaly.

Lakonishok, Shleifer and Vishny (1994) mispricing explanation is based on a theory where the investor sentiment drives the prices of value too low and the prices of glamour too high. Mixed evidence supporting partly this theory and partly the risk-factor theory is found by for example Vassalou and Xing (2004), who find that distress risk explains size and value portfolio returns to some extent, but the value anomaly still significantly persists after this effect is taken into account. Griffin and Lemmon (2002) find similar results concluding that value strategy profits are not fully explained by elevated distress risk, but distress risk still explains some of the value outperformance. Griffin and Lemmon use the Ohlson's O-score to proxy the default probability, which utilizes similar information as Altman Z does but with slightly different ratios. In general it seems that Altman Z is used more often than the Ohlson's O as well as the Altman Z is commented to be the industry standard by for example Dichev (1998). Therefore this paper utilizes Altman Z instead of the Ohlson's O as the distress proxy. These previously discussed results suggest that some of the value strategy return might be explained by elevated distress risk, yet some of the return is still left unexplained by riskiness.

There are also some results arguing that the whole value anomaly is due to mispricing, and the effect of distress risk in explaining that anomaly is insignificant. These papers include Dichev (1998), Petkova and Zhang (2005) and Campbell, Hilscher and Szilagyi (2008). They find that high distress risk companies underperform, but they do not find relation between size or value and distress. Dichev (1998) uses both Altman Z and Ohlson's O as proxies for distress risk, and finds that they work quite similarly, while Z-score is commented to be the industry standard for the distress risk measure. Petkova and Zhang (2005) on the other hand find that value stocks have slightly higher market betas when comparing with growth stocks and utilizing the expected market risk premium instead of the realized one. However, this loading is not nearly enough to explain the value anomaly. Campbell, Hilscher and Szilagyi (2008) find that the distress risk underperformance is the largest in the smallest stocks and the most glamorous stocks. This implies that both the long side of the value portfolio (small companies in general) and the short side (glamour stocks) portfolio might be enhanced by taking into account the distress risk (i.e. distressed glamour stocks chosen in the short side, and non-distressed value stocks in the long side). Lastly, Agarwal and Taffler (2008) find that distress risk drives the Momentum anomaly, and that high distress risk stocks suffer from low returns. However, they also conclude that size and value don't seem to explain distress risk and therefore small stocks or value stocks don't seem to have higher distress risk than larger or more glamorous stocks.

2.2 Review of distress risk measurement and anomaly

This subsection recaps the relevant literature regarding credit/distress risk measures, as well as it introduces results taking a view whether a distress risk anomaly exists.

As shortly mentioned previously, Altman (1968, 2000) has created a key figure, Altman Z, measuring distress risk. This figure contains the information of five ratios: Working capital/Total assets, Retained earnings/Total assets, Earnings before interest and taxes/Total assets, Market value of equity/Book value of total liabilities and Sales/Total assets. Altman ends up with this model by looking at plenty of fundamental variables possibly explaining distress risk. He finds that these remaining five variables are the most significant in determining the distress risk of a company. The Z-score has been utilized in distress risk anomaly research quite a lot and it is commented to be the industry standard by for example Dichev (1998). Therefore Altman Z is utilized as a distress risk measure in this paper.

Issuer credit rating has not been utilized in explaining the distress risk anomaly to similar extent as Altman Z has, but Nickell, Perraudin and Varotto (2001) compare the performance of ratings and equity-based (Altman Z) distress risk measures and conclude that they perform quite equally in determining default probabilities. This gives an incentive to look into the issuer rating based distress risk measurement as well. There is one large upside in measuring distress risk with ratings, and that is that by construction it does not have a similar built-in negative correlation with value strategy that the Z-score has. This correlation is due to value portfolio selection being based on low market value of equity (compared to book value), whereas Z-score selection is partly based on high market value of equity (compared to liabilities). The problem should be considered minor, since this is just one part of the Z-score and the underlying ratio is not completely the same either, but anyway it is prudent to have another way of measuring distress risk for overall robustness. A further positive attribute of the rating based approach is that it does not necessarily take as large of a view on the companies' current operating profitability as for example Piotroski F does (Piotroski, 2000). This means that the ratings based measure might be more appropriate in capturing the distress risk component instead of the operating profitability, which might be an attribute of the value strategy already (result that P/E and P/B value portfolio returns explain each other as stated by Fama and French, 1993).

Lastly regarding the distress risk measurement, Agarwal and Taffler (2008) find that accounting-based distress risk measures (such as Altman Z for example) are able to outperform the market-based measures (such as credit spreads) when creating a distress risk anomaly portfolio. This finding gives the incentive to utilize rating and Altman Z based distress risk proxies instead of for example credit spread proxies.

On the distress risk anomaly, the findings have been quite mixed. Malik and Aftab (2013) use the Z-score as a proxy for distress risk in the Pakistani stock market, and find that distressed companies outperform non-distressed ones. However, they do not take into account other factors than distress risk explaining this phenomenon (for example size factor), and their result is not statistically significant. Furthermore Anginer and Yildizhan (2017) find that the market beta seems to capture all of the return of distress risk anomaly, and therefore the distress risk anomaly does not seem to exist in their sample but it is captured in the market betas instead. Their result implies that distress risk is on average priced correctly in the market.

On the other hand Agarwal and Bauer (2014) notice that with many measures of distress risk, both market and accounting based, low distress risk companies outperform the distressed ones. Furthermore they find that Z-score is able to include all the pricing information from the market model (CDS based), but this does not apply the other way around. This result again argues in favour of using the Z-score as a distress risk proxy. As stated previously, also Dichev (1998), Campbell, Hilscher, and Szilagyi (2008) and Agarwal and Taffler's (2008) find that non-distressed companies outperform distressed ones. Furthermore Dichev (1998) as well as Campbell, Hilscher, and Szilagyi (2008) find that size and value factors are unable to explain this distress anomaly. Agarwal and Taffler (2008) find that Momentum explains the distress risk anomaly whereas Wu (2010) doesn't find similar results on Momentum. Both of them conclude that value and size do not explain the distress risk anomaly.

2.3 Details of most relevant research on value and distress risk

The closest to what is done in this paper can be seen in Piotroski (2000) paper. The main differences between these approaches are that Piotroski uses Piotroski F as his distress risk measure excluding this risk from the value strategy whereas this paper utilizes the Altman Z-score. From these figures, the Piotroski F takes more view to the current operating profitability (6 out of 9 measures are for profitability), whereas the Altman Z-score focuses more on the risk. Furthermore, Piotroski (2000) only considers the long portfolio of the value strategy (i.e. high B/M companies), whereas this paper focuses on the short side of value anomaly introducing a short portfolio of distressed glamour stocks. Moreover, this paper utilizes European data from 2009 to 2018, and rebalances the portfolio as frequently as monthly, whereas Piotroski uses US data until year 2000, and rebalances his portfolios either annually or biannually. Lastly, Piotroski doesn't look into whether his new strategy loads on different benchmark portfolios. He looks into what kind of companies are left in the long portfolio (small value), but he doesn't take a look whether the returns of this new portfolio still load on the SMB, HML, MOM or other factor portfolios. This paper focuses on whether the strategy loads especially on SMB, HML and distress risk factor portfolios, but also on other selected factor portfolios and whether the strategy alpha remains significant after these controls.

Piotroski's (2000) findings are that accounting-based fundamental analysis can improve the value long portfolio returns significantly. He finds that by choosing financially strong value stocks, he can improve the long portfolio raw returns by 7.4% annually. He also finds that the most benefit can be found in small companies with no analyst following, which sounds intuitive; It is possible to create value with one's own analysis when the data and information regarding that specific company is hard to find. It is likely that this study finds similar outperformance, but the outperformance of this paper is likely to originate from the reduced risk rather than increased return. Then of course via leverage the risk or return can be matched, but this comment is merely to illustrate the difference in portfolio construction. Furthermore this paper is expected to shed more light on what factor portfolios explain the returns of a distress risk eliminated long/short value portfolio whereas Piotroski (2000) looks whether his long portfolio includes small value companies.

Furthermore, in table 1 one can see a comparison between the methodology, scope and focus of this paper and previous papers on the subject. One can see that previously raw returns on long portfolios have been the focus area on the topic, and the US market has been in the scope of these studies. Further we can see that only Piotroski (2000) has utilized an approach where he simultaneously includes constant distress thresholds in time and selects constant amount of companies in the long portfolio. Moreover we notice that the portion of stocks in the long portfolio has mostly been between 2-11% only time-varying in the study of Agarwal and Taffler (2008), where the portion of stocks in the portfolio should be between 0% and 20% at all times. In this paper a constant 5% of all stocks are chosen in both the long and short portfolio with a constant distress risk cutoff and time-varying P/B thresholds. Moreover this paper introduces a short portfolio of distressed glamour stocks, and monitors the long/short portfolio loadings on a distress risk factor portfolio as well as FF5 + MOM factor portfolios.

Table 1: Comparison of methodology, scope and focus of papers regarding value and distress

Value and distress					
Paper	**Value methodology**	**Distress methodology**	**Geography**	**Focus**	**Portion of stocks selected in the long portfolio**
Friewald, Wagner and Zechner (2014)	Three categories for B/M (percentiles)	Three categories for CDS (percentiles)	US	Long portfolio return, Raw and FF3	11%
Vassalou and Xing (2004)	3-5 categories for B/M (percentiles)	3-5 categories on own bankruptcy prediction model (percentiles)	US	Long portfolio return, Raw and FF3	4-11%
Griffin and Lemmon (2002)	Three categories for B/M (percentiles)	Three categories for Ohlson's O (percentiles)	US	Long portfolio return, Raw and FF3	11%
Petkova and Zhang (2005)	HML (5x5 size and value, small value minus small growth, percentiles)	No cutoff	US	Whether small HML loads on expected market return factor	4%
Campbell, Hilscher and Szilagyi (2008)	No cutoff	20 categories based on own bankruptcy prediction model (percentiles)	US	Whether distressed stocks load on size, market and HML factors	5%
Agarwal and Taffler (2008)	Five categories for B/M (percentiles)	Constant thresholds on scaled Altman Z (<0 and >0)	US	Whether Momentum proxies distress risk and whether size and B/M are linked with distress. Long portfolio	Varies in time and cannot be monitored. Should be between 0 and 20%
Piotroski (2000)	Five categories for B/M (percentiles)	Nine categories on Piotroski F (constant)	US	Raw return	2-5%
My paper (2018)	5% of total stocks in both long and short by B/M that comply distress rule.	Constant thresholds on Altman Z (<2.3 and >5)	EU	Long/Short portfolio, loading on distress factor controlling for FF5 + Mom	5%

3 HYPOTHESES

Linked to the discussions between Fama and French (1993, 1995, 1996), Lakonishok, Shleifer and Vishny (1994) and many more, the hypotheses in this paper are based on theories that the outperformance of the value strategy is to some extent due to higher distress risk (Fama and French, 1993) of the companies in the value strategy long portfolio and to some extent due to investor sentiment (Lakonishok, Shleifer and Vishny, 1994) underpricing value stocks and overpricing glamour stocks. The first hypothesis can be formulated as follows:

1) The plain value portfolio stocks are more distressed than plain glamour portfolio stocks.

The above hypothesis is based on the Fama and French (1993) theory that the HML factor is in fact a factor capturing higher riskiness of value stocks compared to glamour. This is tested by creating a distress risk factor based on Altman Z, and looking into whether the traditional value strategy portfolio loads significantly on this factor. Furthermore the paper compares the proportion of distressed stocks in the value long and short portfolios to conclude whether one of them has higher credit risk by construction. It is expected that the value portfolio includes more distressed stocks than the glamour portfolio, but it is still possible to find some non-distressed value stocks. This would imply that part of the value portfolio outperformance is due to mispricing, which leads to the second hypothesis:

2) Eliminating distress risk exposure from the plain value portfolio enhances the portfolio performance.

This is based on Lakonishok, Shleifer and Vishny (1994) theory that some of the value stock anomaly is due to mispricing caused by investor sentiment. Regarding this, the paper looks into whether the cumulative return and Sharpe ratio of the distress risk eliminated value strategy are higher than those of the plain value strategy. Further the return of the distress risk eliminated value strategy is regressed against chosen benchmark portfolios and seen whether positive and significant alphas persist. Furthermore, the paper looks into whether this distress risk eliminated value strategy loads on the SMB, HML and distress risk factors specifically. In this paper a short leg for distress risk eliminated value strategy is introduced. This short portfolio consists of distressed glamour stocks. The third hypothesis relates to this short portfolio and can be formulated as:

3) It is possible to find distressed glamour stocks from the market, and these stocks underperform compared to other glamour stocks.

This hypothesis is again based on Lakonishok, Shleifer and Vishny (1994) theory that investor sentiment creates mispricing in the market. The paper argues that since it seems to be possible to find non-distressed value stocks to be long, it is also possible to find distressed glamour stocks to be short. The paper first studies whether distressed glamour stocks can be found in the market, and later looks into whether this short leg of distressed glamour creates more value than a short leg of non-distressed glamour.

4 DATA AND METHODOLOGY

This section first discusses the data selection process, as well as the scale and scope of the data. Later the section covers the methodology used in portfolio construction and rebalancing as well as in the calculation of returns. Lastly it discusses the benchmark portfolios and introduces regression models used.

4.1 Data

The paper utilizes monthly data for EuroStoxx600 companies including total returns, Price-to-Book ratios, Altman Z figures and Issuer ratings from Thomson Reuters Eikon for the period of 01/2009 – 12/2018. Furthermore, the EuroStoxx600 index total return for the same time period is used as the benchmark market return, since it is the closest market return benchmark for this population of companies. The time period from 2009 to 2018 is chosen due to limitations of data before year 2009. Practically this is due to unavailability of good quality Altman Z figures and Issuer ratings. Moreover, the paper is most interested in the recent performance of the distress risk eliminated value strategy, and therefore choosing the most recent data also fits into the scope of the study.

After collecting the data, it is controlled rigorously to notice possible inconsistencies as well as missing values. It seems that good quality time series data is available for 388 companies for the Altman Z and 245 companies for the Issuer rating for the time period in scope. Therefore the sample companies going forward are these 388 for the Altman Z based strategy and 245 for the Ratings-based approach. Furthermore as the benchmark value portfolio creation, the paper utilizes the same 388 companies as for the Altman Z based value strategy. This is to make sure that the comparison is made between companies from the same sample space. Also the distress risk factor portfolio is created from the Altman Z consistent data.

As discussed in the chapter above, the market and distress risk factor portfolio returns are calculated based on the EuroStoxx600 data. Other factor portfolio returns, as well as the risk-free rate are fetched from the Kenneth French data library, utilizing the European monthly data there. From this source the FF5 portfolios and the Momentum portfolio (SMB, HML, MOM, RMW, CMA) are chosen as the additional factor portfolios.

Below in table 2 one can see descriptive statistics of the data set utilized. The portfolio selection is covered in more detail in the methodology section.

Table 2: Descriptive information on the data used in portfolio selection

In the below table one can see descriptive information of the data fetched from Thomson Reuters to create the distress risk eliminated value portfolio. This is time series data for years 2009 – 2018 of monthly total return, P/B, Altman Z-score and Issuer rating for all EuroStoxx600 companies. For Altman Z portfolio selection 20 stocks (Altman Z over 5, 20 lowest P/B figures) are chosen in the long portfolio and 20 stocks (Altman Z under 2.3, 20 highest P/B figures) in the short portfolio based on the Altman Z and P/B figures. For the rating based approach, 20 lowest P/B companies with a rating better than A+ are selected in the long portfolio and 20 highest P/B companies with rating lower than BBB in the short portfolio. In the plain value portfolio 20 lowest P/B stocks are chosen in the long portfolio and 20 highest P/B stocks in the short portfolio.

	Raw data	Altman Z control	Rating control	W/o distress control
No. of companies	600	388	245	388
No. of months (time points)	120	120	120	120
Time period	01/2009 - 12/2018	01/2009 - 12/2018	01/2009 - 12/2018	01/2009 - 12/2018
No. of long positions	-	20	20	20
No. of short positions	-	20	20	20
Z long boundary (1)	-	5	-	-
Z short boundary (2)	-	2.3	-	-
Rating long boundary (1)	-	-	A+	-
Rating short boundary (2)	-	-	BBB	-
P/B, average realized long boundary (2)	-	1.79	1.45	0.74
P/B, average realized short boundary (1)	-	3.12	2.57	9.23

(1) The respective figure must be higher for the company to be chosen in the portfolio.
(2) The respective figure must be lower for the company to be chosen in the portfolio.

The paper also looks into the data to see whether the overall distress risk seems to be higher in the plain value long portfolio compared to the short portfolio. In table 3 below you can see the results of this analysis. From this table we can see that the value long portfolio includes more distressed companies by all measures, which indicates that at each point in time the value long portfolio is likely to include more distress risk than the short portfolio. This argues in favour of the risk-based approach i.e. that the value anomaly might be at least partly due to higher distress risk in the long portfolio compared to the short portfolio. Furthermore this result motivates to study whether it is possible to exclude the distress risk from the value long portfolio and still outperform the market with the value strategy.

Table 3: Aggregated distress risk of plain value long and short portfolios

In this table one can see statistics of the average Z-scores and Ratings for the plain value long and short portfolios, where the lowest 20 P/B stocks are chosen in the long portfolio and 20 highest P/B stocks in the short portfolio for each month. Regarding the calculations, first an average is computed for each portfolio in each time point, and then the quartiles, average, minimum and maximum are calculated from the portfolio level time series data.

	Average distress of portfolio at each point in time			
	Value long		Value short	
	Z-score	Rating	Z-score	Rating
Count	120	120	120	120
Mean	4.5	A+	15.6	AA+
Min	1.4	BBB	4.6	AA-
25%	2.4	A	10.9	AA
50%	4.1	A+	13.7	AA+
75%	5.5	AA-	22.1	AA+
Max	16.1	AA	34.0	AAA

Further the paper introduces a short portfolio of distressed glamour stocks. This is based on an argument that since it seems that it is possible to be long non-distressed value stocks (Piotroski, 2000, Griffin and Lemmon, 2002) it could be possible to find distressed glamour stocks to be short. Tables 4 - 9 below show descriptive statistics on the proportions of distressed/non-distressed value and glamour stocks during 2009 - 2018. First table 4 illustrates the shares of value and glamour stocks within the sample. We can see that the median share of value stocks (proxied by P/B < 2) is 38.1% and the median share of glamour stocks (proxied by P/B > 3) is 38.7%. This amount is specified larger than the usual share of value and glamour stocks of 20% chosen in value long/short portfolios, since otherwise the amount of stocks would be too small to further divide into distress categories. The current amount of value and glamour stocks provides sample sizes large enough to divide them into distress risk categories.

Tables 5 – 9 show that the proportion of most distressed stocks is much larger in value stocks than it is in glamour stocks (34% vs. 11% on average) and similarly the share of least distressed stocks is far higher among the glamour stocks than it is in value stocks (57% vs. 13%). We also notice that the proportion of the least distressed value stocks is around as large as the proportion of most distressed glamour stocks (11% vs. 13%). This indicates that it is roughly as possible to find non-distressed value stocks as it is to find distressed glamour stocks. Furthermore in table 9 we see that the difference between the proportions of value and glamour stocks varies so that the more distressed the stocks are, the larger is the share of value stocks compared to glamour. Lastly we can see in tables 5 and 6 that the possibility to find the least distressed value stocks and most distressed glamour stocks in the whole sample has been similar (between 4.4% and 5.9% for least distressed value and between 3.4% and 4.6% for most distressed glamour in the first and third quantiles). This again indicates that it is equally likely to find distressed glamour stocks as it is to find non-distressed value.

To give some examples of these distressed glamour stocks, we can look at Tesla (P/B ratio 13.3 and Z-score 1.3 at the end of 2018) and Outotec (P/B ratio 3.5 and Z-score 2.1 in mid-2018). The price of Outotec has fluctuated a lot between 2.5€ and 13€ during 2009 - 2018, but the returns of the stock during times when the short position has been open is -35.3% annually, whereas during periods the position has not been open the return of the stock has been +27.7%. When excluded from the short position early during the sample period (2009 – 2015) the reason is mostly the Z-score cutoff and later (2018) the value cutoff. This result indicates that both the value and distress risk measures include information on the potential mispricing of Outotec during the period, and these indications seem to be correct on average. Regarding Tesla the results are not as easy to interpret, since the annual return of the stock when short position have been open is 49.1%, whereas it is only 30.0% during times when the position would have been closed. This is due to one time period, 2013 – 2014, being highly profitable for Tesla, and the short position being open throughout this period. When looking into the returns of Tesla after year 2014, the yearly stock return has been 8.0% when the short position has been open and 26.2% when it has been closed. Whenever Tesla has been excluded from the short position, the underlying reason has been the Z-score. This result indicates that the distress risk measure includes information of Tesla's potential mispricing, but there has been times when the information has proven to be incorrect.

The examples above indicate that the short position cutoffs (both value and distress) seem to work quite well on average (Outotec during the whole period, Tesla after 2015), but time to time short positions in single stocks might suffer heavy losses (Tesla during 2013 – 2014) since the information is not by any means perfect.

Table 4: Share of value and glamour stocks during 2009 – 2018

The table below illustrates the share of value and glamour stocks compared to all stocks in the sample. Glamour stocks are specified as stocks with P/B figure over 3 and value stocks as stocks with P/B figure below 2. The share of stocks is first calculated for each month during 2009 – 2018, and then the relevant statistics are calculated from that time series.

	Share of total stocks in time	
	Value	Glamour
Mean	41.1%	37.0%
Min	29.9%	18.8%
25%	33.5%	30.6%
50%	38.1%	38.7%
75%	47.4%	43.8%
Max	64.7%	49.2%

Table 5: Value stocks during 2009 – 2018 divided to distress categories, Share of total amount of stocks

The table below illustrates the share of value stocks divided to five distress risk categories compared to all stocks in the sample. Value stocks are specified as stocks with P/B figure below 2. ValND category includes stocks with Z-score higher than 5, Val2 Z-score between 3 and 5, Val3 between 2.3 and 3, Val4 between 1.8 and 2.3 and ValD below 1.8. The share of stocks is first calculated for each month during 2009 – 2018, and then the relevant statistics are calculated from that time series.

	Share of total stocks in time				
	ValND	Val2	Val3	Val4	ValD
Mean	5.5%	10.5%	6.2%	4.9%	14.0%
Min	3.1%	6.7%	3.9%	2.1%	9.5%
25%	4.4%	9.0%	4.6%	3.6%	10.8%
50%	5.2%	10.3%	5.7%	4.4%	13.1%
75%	5.9%	11.9%	7.7%	6.4%	16.4%
Max	13.9%	17.3%	10.3%	8.8%	24.5%

Table 6: Share of glamour stocks during 2009 – 2018 divided to distress categories, Share of total amount of stocks

The table below illustrates the share of glamour stocks divided to five distress risk categories compared to all stocks in the sample. Glamour stocks are specified as stocks with P/B figure above 3. GlamND category includes stocks with Z-score higher than 5, Glam2 Z-score between 3 and 5, Glam3 between 2.3 and 3, Glam4 between 1.8 and 2.3 and GlamD below 1.8. The share of stocks is first calculated for each month during 2009 – 2018, and then the relevant statistics are calculated from that time series.

	Share of total stocks in time				
	GlamND	Glam2	Glam3	Glam4	GlamD
Mean	21.1%	7.8%	2.5%	1.5%	4.0%
Min	8.5%	4.6%	0.3%	0.0%	2.3%
25%	16.2%	7.0%	1.5%	1.0%	3.4%
50%	22.2%	7.7%	2.6%	1.5%	3.9%
75%	26.0%	8.8%	3.1%	2.1%	4.6%
Max	29.6%	11.1%	4.9%	2.8%	6.4%

Table 7: Value stocks during 2009 – 2018 divided to distress categories, Share of total amount of value stocks

The table below illustrates the share of value stocks divided to five distress risk categories compared to all value stocks in the sample. Value stocks are specified as stocks with P/B figure below 2. ValND category includes stocks with Z-score higher than 5, Val2 Z-score between 3 and 5, Val3 between 2.3 and 3, Val4 between 1.8 and 2.3 and ValD below 1.8. The share of stocks is first calculated for each month during 2009 – 2018, and then the relevant statistics are calculated from that time series.

	Share of value stocks in time				
	ValND	Val2	Val3	Val4	ValD
Mean	13.3%	25.9%	15.1%	11.7%	33.9%
Min	8.6%	16.2%	9.1%	5.9%	23.4%
25%	10.9%	22.8%	13.1%	9.9%	31.7%
50%	12.6%	25.7%	15.5%	11.9%	33.1%
75%	15.4%	28.3%	17.2%	13.7%	35.0%
Max	22.3%	34.8%	20.5%	18.2%	46.4%

Table 8: Glamour stocks during 2009 – 2018 divided to distress categories, Share of total amount of glamour stocks

The table below illustrates the share of glamour stocks divided to five distress risk categories compared to all glamour stocks in the sample. Glamour stocks are specified as stocks with P/B figure above 3. GlamND category includes stocks with Z-score higher than 5, Glam2 Z-score between 3 and 5, Glam3 between 2.3 and 3, Glam4 between 1.8 and 2.3 and GlamD below 1.8. The share of stocks is first calculated for each month during 2009 – 2018, and then the relevant statistics are calculated from that time series.

	Share of glamour stocks in time				
	GlamND	Glam2	Glam3	Glam4	GlamD
Mean	56.5%	21.6%	6.4%	4.1%	11.3%
Min	41.6%	14.0%	1.2%	0.0%	7.1%
25%	54.2%	19.2%	5.2%	2.8%	8.7%
50%	56.7%	21.6%	6.4%	4.6%	9.9%
75%	59.9%	23.9%	8.1%	5.4%	13.3%
Max	67.6%	31.6%	10.2%	7.1%	21.2%

Table 9: Difference between the share of value stocks and glamour stocks in different distress categories during 2009 – 2018

The table below illustrates the difference between shares of glamour stocks from table 8 and value stocks in table 7 divided into distress categories. The figures are calculated similarly as in tables 7 and 8, and then deducted from each other.

	Difference between share of value stocks and glamour stocks in time				
	ND	2	3	4	D
Mean	43.1%	-4.3%	-8.7%	-7.6%	-22.6%
Min	33.0%	-2.3%	-7.9%	-5.9%	-16.3%
25%	43.3%	-3.6%	-7.9%	-7.0%	-23.0%
50%	44.1%	-4.1%	-9.1%	-7.4%	-23.1%
75%	44.5%	-4.4%	-9.1%	-8.3%	-21.7%
Max	45.3%	-3.1%	-10.3%	-11.1%	-25.3%

4.2 Methodology

After cleaning the data, the 388 companies are used to create plain value and Altman Z controlled value long/short portfolios, and the 245 companies to create Issuer rating controlled value long/short portfolio. For the plain value strategy, the lowest 20 P/B (or highest B/M) stocks are chosen in the long portfolio and the highest 20 P/B stocks in the short portfolio at each time point so that the companies selected for January portfolio are based on previous December figures. This is of course due to the fact that December figures are the latest ones available to create a portfolio on January 1st. This 20 company (or around 5%) threshold in the plain value portfolio construction is used to be able to choose the same amount of companies in the distress risk eliminated portfolios, and still be able to diminish between value and glamour stocks well enough.

For the distress risk eliminated portfolios, the distress risk is first eliminated in a way that high risk stocks are excluded from the long portfolio selection, and only distressed stocks are included in the short portfolio selection. After this the same amount of companies from these populations are chosen to the non-distressed value long and distressed glamour short portfolios as in the plain value and glamour portfolios based on the P/B percentiles. This is due to not wanting the results to be affected by more rigorous overall stock selection instead of the distress risk cutoffs. For the distress risk cutoffs, highest percentiles of the distress risk figure are not utilized at each time point, but instead a constant distress risk cutoff is applied through time. This is due to not wanting to give away in the distress risk cutoff when more stocks are distressed to capture the possible value creation of rigorous distress risk elimination during distressed time periods as well. The paper studies the data to see on what levels of distress risk elimination it is still possible to clearly diminish between value and glamour stocks, keeping in mind that the Altman Z has to be larger than 3 for the long portfolio and lower than 2.6 for the short portfolio. These are considered to be the “Safe” zone and “Grey” zone in the literature regarding Altman Z (Altman, 1968, 2000). After this analysis, Z-scores lower than 2.3 are included in the short portfolio and higher than 5 in the long portfolio. If these limits are made more rigorous, the P/B percentiles start capturing value stocks in the short portfolio and glamour stocks in the long portfolio, and that would not be in the scope of this research. As stated in the limitation section, the tradeoff between distress risk and value cutoffs is not optimized in this paper to avoid overfitting the data. This also means that the portfolio returns could be further improved by optimizing the level of distress risk cutoff compared to the value cutoff. However, the paper tests the sensitivities of the results by altering these distress risk thresholds. These results are discussed in subsection 5.5. Furthermore monthly, quarterly and yearly portfolio rebalancing is considered in the research, to see whether shorter or longer holding period creates more value to the strategy.

For the ratings based approach, portfolios with similar rigorousness regarding the P/B figure as for the Altman Z based approach are created. This is to keep the two portfolios as comparable to each other as possible. By studying the data it seems that the most similar P/B thresholds can be achieved with a long portfolio rating boundary of over A+ and a short portfolio boundary of under BBB. After this the return of each long and short portfolio is analysed individually. The analysis concludes that the Altman Z based long and short portfolios perform very well (low returns for short, high returns for long), whereas the rating based long and short portfolios perform quite similarly with each other. Therefore it is not meaningful to conduct further analysis regarding the rating based long/short portfolio, since the return of that portfolio seems to be around zero. These portfolio returns can be seen in figure 3. Going further, only the Altman Z based distress risk elimination is utilized in the analysis.

As for the plain distress risk factor portfolio, top 20 Altman Z stocks are chosen in the long portfolio and bottom 20 in the short portfolio. This is the same amount of stocks as in the plain value and distress risk eliminated value portfolios, and the amount is chosen to maintain the same level of rigorousness in the overall selection process.

The return calculation is as follows: First the risk-free rate rf is deducted from all the EuroStoxx600 company returns $r_{i_{raw}}$ as well as from the index return $r_{m_{raw}}$ for every month t:

$$r_{i,t} = r_{\mathrm{i,t_{raw}}} - rf_t$$

$$r_{m,t} = r_{\mathrm{m,t_{raw}}} - rf_t$$

Then the utilized long, short and long/short portfolios for value ($VLong, VShort,\ V$), distress ($DLong, DShort,\ D$) and distress risk eliminated value ($DVLong, DVShort,\ DV$) are created as equally weighted portfolios including stocks chosen by the criteria discussed above. Below you can see an example of the mathematical formulation of the distress risk eliminated value portfolios. The construction is similar for the other portfolios:

$$DVLong_t = \frac{1}{n}\sum_{i=1}^{n} r_{i,t_{DVLongCriteria}}$$

$$DVShort_t = \frac{1}{n}\sum_{i=1}^{n} r_{i,t_{DVShortCriteria}}$$

$$DV_t = \frac{DVShort_t + DVLong_t}{2}$$

After this it is possible to compare the long, short and long/short portfolios with each other, since all of them are scaled correctly and adjusted with the risk-free return. Going forward the linear regression models with autocorrelation and heteroscedasticity robust covariance matrices are created with $FF3, FF5, FF3 + MOM, FF5 + MOM, FF3 + D$ and $FF5 + MOM + D$ factor portfolios, where $FF3$ includes $Mkt - RF, SMB$ and HML portfolios and $FF5$ includes RMW and CMA portfolios additionally. The $Mkt - RF$ stands for the market portfolio adjusted with the risk-free rate, SMB for the Small-Minus-Big, HML for the High-Minus-Low, RMW for the Robust-Minus-Weak, CMA for the Conservative-Minus-Aggressive, MOM for the Momentum and D for the Distress risk factor portfolios. The documentation for the construction of SMB, HML, RMW and CMA portfolios can be found in Fama and French (1993, 1995, 1996), for MOM in Carhart (1997) and for $Mkt - RF$ and D in this paper. The below formula illustrates the linear regression model including all the variables of interest as well as the control variables. The other models are constructed similarly.

$$DV_t = \propto + \beta_1(Mkt_t - RF_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \beta_5 RMW_t + \beta_6 CMA_t + \beta_7 D_t + \varepsilon_t$$

Further we can compare the approach of this paper with Piotroski (2000) and Griffin and Lemmon (2002). These studies are considered to be the closest benchmarks to this paper. Piotroski (2000) computes his portfolios by first dividing the companies in 9 groups based on F-Scores from 1 to 9. He then uses two approaches in his study. First he selects only the highest quintile B/M companies in his analysis, and studies whether the returns in different Piotroski F categories differ from each other. He notices that the raw returns in the high Piotroski F portfolio beats the low portfolio by 7.4% annually. However, he only takes a view on 1- and 2-year holding periods for value long portfolios in the US market. He also does not control whether these long portfolio returns are explained by any benchmark portfolios, but focuses on the raw returns instead. Furthermore he divides the Piotroski F categories into three size buckets each and notices that the effect of eliminating the distress risk is the largest within the smallest companies. Again he focuses on the raw returns of the long portfolios. What we find similar in his approach and the approach utilized in this paper is that the distress risk proxies used are constant in time (his groups from Piotroski F are integers between 1 and 9, and this paper's Z-scores over 5 or under 2.3). This means that the distress risk proxy does not vary in time based on the average distress at each time point. The rest however is different since he focuses on long portfolios and raw returns instead of creating long/short portfolios and looking into their factor loadings and potential alphas.

Griffin and Lemmon (2002) on the other hand create their portfolios by dividing the companies to 5 categories based on Ohlson's O (distress) measure. Then they further divide these categories into three B/M portfolios each, and calculate long portfolio returns for each of these. Again they focus on the long portfolios, which means that they do not observe the value that can be added by a short side and creating a long/short portfolio with this strategy. Their study shows the mean returns of all portfolios and considers whether the returns are on average higher in the distress risk eliminated value portfolio, but it is not shown whether the volatilities differ between the portfolios, and moreover whether making a long/short portfolio would further decrease the return volatility. Also their distress risk cutoff is not constant in time, and therefore they include more distress risk in their long portfolio during more distressed times, which might not be a wanted characteristic. They also regress their long-portfolio returns against the market, SMB and HML portfolios, but they do not look into whether it is possible to explain these returns with a distress risk factor portfolio. This paper discusses whether the distress risk factor portfolio explains the returns of a distress risk eliminated value strategy to monitor whether distress risk elimination enhances the returns of the value long/short portfolio more than it enhances the market portfolio return. Griffin and Lemmon (2002) also focus on American stocks before year 2000, and cover only annual rebalancing of their portfolios.

Further to make it clear what kind of stocks are chosen in the long and short portfolios of this paper: The strategy is long value stocks (high B/M) that are not distressed (high Altman Z or rating) and short glamour stocks (low B/M) that are distressed (low Altman Z or rating). This means that the strategy is long stocks where their low valuation is not due to high distress risk and short stocks where the high valuation is not due to strong financial position. With this approach potentially mispriced stocks found in subsection 4.1 are invested in. It is further analysed if non-distressed glamour creates a better short leg for the non-distressed value than the distressed glamour does. This analysis is covered in subsection 5.1.

Lastly to shortly summarize the contribution comparing to previous studies: This paper studies whether creating a long/short portfolio with distress and value cutoffs outperforms the traditional value strategy, whereas previous studies focus on the long portfolios only. The short portfolio created includes distressed glamour stocks, and given this the paper also studies whether it is possible to find distressed glamour stocks and whether the distressed short leg creates more value than non-distressed glamour. Also previously less utilized factor portfolios (namely RMW, CMA, MOM and Distress risk factor portfolios) are introduced potentially explaining this long/short portfolio return. The overall focus of this paper is more on the risk-adjusted returns of this strategy instead of the raw returns that have been the focus of the long portfolio research earlier. This might create new insights on what is behind the value anomaly after the distress risk is eliminated. Furthermore the paper studies whether shorter than one-year rebalancing creates value for this strategy. Lastly, a new geographic area in Europe is introduced instead of dealing with US stocks, as well as a more recent time period of 2009-2018 is utilized compared to before year 2000.

5 RESULTS

This section first defines the relevant short portfolio for the strategy, after which the raw and risk-adjusted returns of the distress risk eliminated value strategy are compared with the plain value strategy during 2009 – 2018 with monthly portfolio rebalancing. Then the section further compares the results between 1M, 3M and 12M holding periods and divides the time period to two five year periods 2009 – 2013 and 2014 – 2018 and takes a look whether the results seem similar between these. Lastly the results with altered value and distress risk cutoffs are studied to monitor the robustness of the baseline results, i.e. that the baseline results are not due to arbitrary selection of cutoffs.

The most important results can be divided into three points:

1. It is possible to find distressed glamour stocks in the market.
2. These distressed glamour stocks are a better short leg for the non-distressed value strategy than non-distressed glamour stocks are.
3. The performance of the distress risk eliminated value long/short portfolio is high during the whole period, even when the traditional factor portfolios don’t perform.

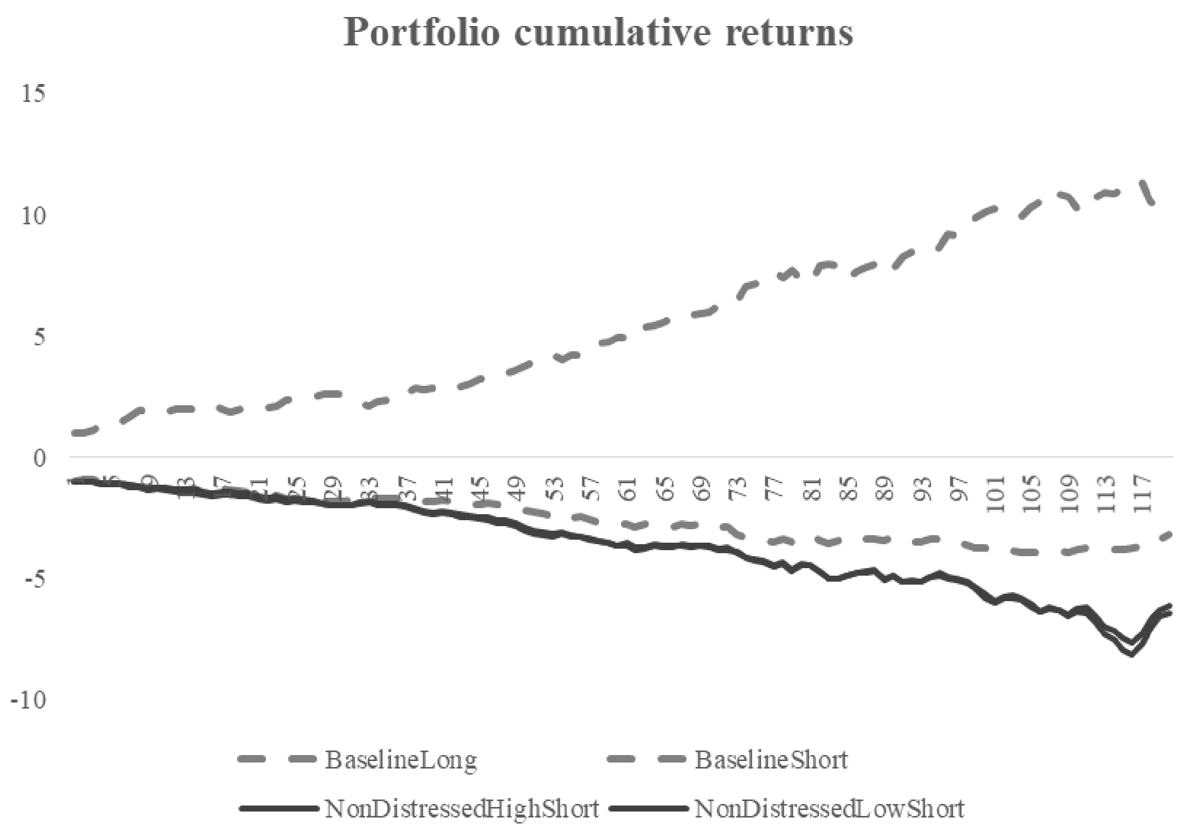
The first two points show that distress risk is not priced correctly in glamour stocks whereas the last point indicates that utilizing this incorrect pricing of distress risk, it is possible to outperform the traditional value long/short portfolios.

5.1 Defining the relevant short portfolio

There are two main options to create the short side portfolio: either be short non-distressed glamour stocks or distressed glamour stocks. Following the mispricing theory of Lakonishok, Shleifer and Vishny (1994) it should be possible to find distressed glamour stocks, which would be overpriced in relation to their distress risk. In subsection 4.1 it is found that these distressed glamour stocks exist, and the amount of them is similar to the amount of non-distressed value.

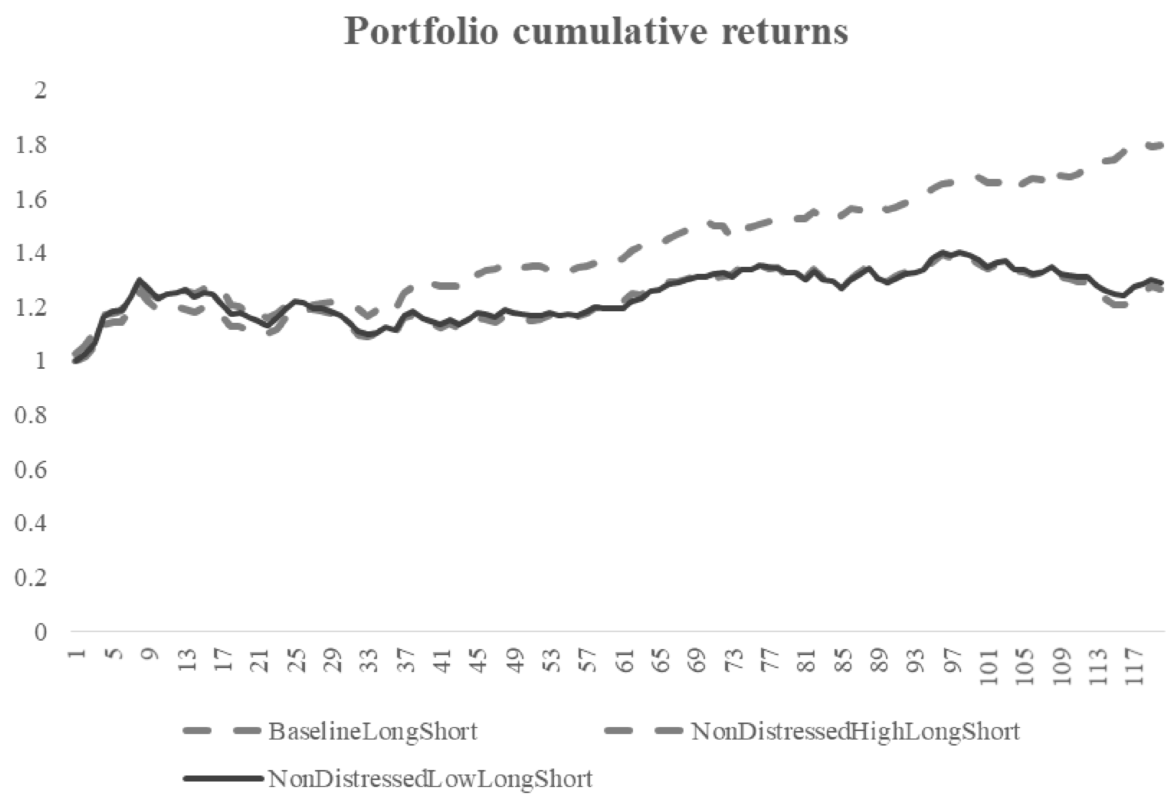
However it might still be that the distress risk is priced correctly in these glamour stocks, and therefore it might not create value to be short distressed glamour. Moreover it might be that the volatility patterns are similar between non-distressed glamour stocks and non-distressed value stocks, and this non-distressed portfolio would then create a better hedge for the non-distressed value long portfolio. It might also be that non-distressed glamour stocks are less volatile than non-distressed value and distressed glamour, which might lead to distressed glamour being the relevant short leg after all. Given these considerations, this subsection studies whether non-distressed or distressed glamour seems to be more relevant short leg for non-distressed value.

Figure 1: Cumulative returns for the baseline long and short portfolios as well as short portfolios including non-distressed glamour stocks



In the figure above we can see the portfolio returns of the baseline long and short portfolios as well as two alternative short portfolios including non-distressed glamour stocks. The returns are calculated as being long in the long portfolio and short in the short portfolios. The baseline long portfolio includes 20 lowest P/B stocks with Z-Score over 5 and the baseline short portfolio 20 highest P/B stocks with Z-score lower than 2.3. Further the NonDistressedHigh short portfolio includes 20 highest P/B stocks with Z-score higher than 5, and the NonDistressedLow short portfolio 20 highest P/B stocks with Z-score higher than 2.3. These short portfolios include either distressed glamour stocks (baseline) or non-distressed glamour stocks with two different specifications. All the portfolios are equally weighted and rebalanced monthly.

Figure 2: Cumulative returns for the baseline long/short portfolio and long/short portfolios including non-distressed glamour stocks in the short leg



In the figure above we can see the portfolio returns of the baseline long/short portfolio as well as two alternative long/short portfolios including non-distressed glamour stocks in the short leg. The portfolio used as the long leg off all long/short portfolios includes 20 lowest P/B stocks with Z-Score over 5. The baseline short portfolio includes 20 highest P/B stocks with Z-score lower than 2.3, the NonDistressedHigh short portfolio 20 highest P/B stocks with Z-score higher than 5, and the NonDistressedLow short portfolio 20 highest P/B stocks with Z-score higher than 2.3. These short portfolios include either distressed glamour stocks (baseline) or non-distressed glamour stocks with two different specifications. The long/short portfolio returns are calculated as being long the long portfolio and short each of the short portfolios separately. All the portfolios are equally weighted and rebalanced monthly.

Figure 1 above shows the cumulative returns of the long portfolio including non-distressed value stocks and the baseline short portfolio including distressed glamour as well as two short portfolios including non-distressed glamour with different distress risk cutoffs (NonDistressedHigh, Z-score > 5 and NonDistressedLow, Z-score > 2.3). We notice that the non-distressed glamour portfolio returns are higher than those of the distressed glamour (in fact 19.0 – 19.4% vs. 12.5% annually). This indicates that it is possible to find distressed glamour stocks that are more mispriced than non-distressed glamour and therefore the distressed glamour could create a more relevant short leg for this strategy. Furthermore the correlation between the non-distressed value and distressed glamour short portfolio is -0.76, when it is only -0.68 between the non-distressed value and non-distressed glamour portfolios. This is quite surprising but it might be due to distressed stocks and value stocks in general moving similarly, which means that it might be better to include value in the long leg and distress in the short leg than to include value in the long leg and no distress in the short leg. Also the volatilities are closer to each other with the distressed short leg than with the non-distressed ones (long volatility 17.5%, distressed short 13%, non-distressed 12.3%). This is not surprising since Fama and French (1993) find that value stocks have higher volatility than glamour stocks and Malik and Aftab (2013) find that distressed stocks are more volatile than non-distressed. All of these results imply that the distressed glamour would be a more suitable short leg for non-distressed value.

Figure 2 shows the long/short portfolio returns for portfolios that are long non-distressed value and short either distressed (Baseline) or non-distressed (NonDistressed) glamour stocks. Here we see that the returns are both higher (6.0% vs. 2.5 – 2.7% annually) and more stable (5.7% vs. 6.3% volatility) when shorting the distressed glamour. This result is due to the returns, volatilities and correlations discussed in previous chapter and they imply that the distressed glamour creates a better short leg for non-distressed value than non-distressed glamour does. This is likely due to more mispricing in distressed glamour compared to non-distressed as well as plain value and plain distressed stock returns being similar to some extent. With these analyses the distressed glamour is chosen to be the short leg of the strategy.

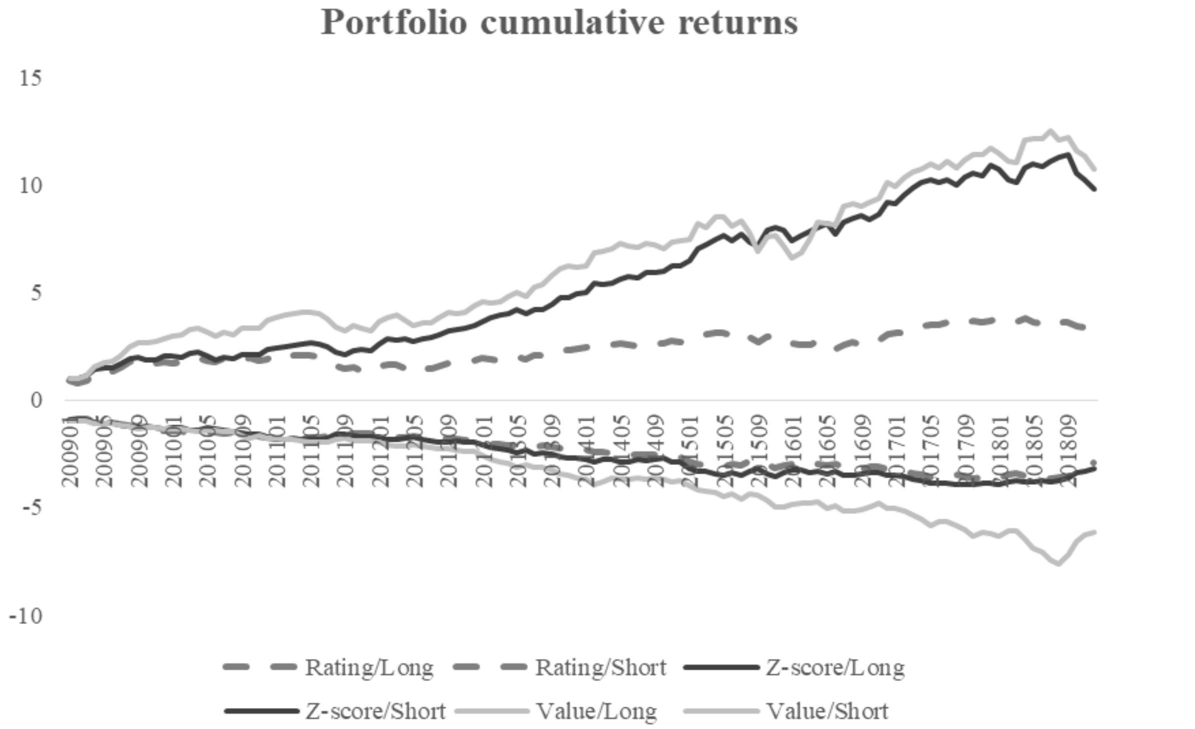
5.2 Base case distress risk eliminated value and plain value comparison

In this subsection the long and short portfolio returns of plain value, value with rating cutoffs and value with Altman Z cutoffs are compared individually with each other. In figure 3 we can see the cumulative returns of these long and short portfolios. We notice from the long side that the cumulative returns of the Altman Z value portfolio and the plain value portfolio are similar in scale. We can also note that the returns of the Altman Z value long portfolio are a bit more stable than the ones of the plain value long portfolio. The clearest this can be noticed during years 2015 – 2016, where there is a clear dip in the plain value long portfolio returns, similar which cannot be observed in the Altman Z value portfolio. Furthermore we can see the difference when looking into the mean returns and standard deviations of these portfolios. The Z-Score value long portfolio mean return is 24.5% and its volatility is 17.5% whereas the same figures for the plain value long portfolio are 26% and 22.1%. We also notice that the rating value long portfolio returns are low (14.4% annually) compared to the other long portfolios, and therefore it seems that eliminating distress based on rating doesn't seem to capture the same value as eliminating based on Altman Z does. This might be due to rating taking more of a view to the collateral values of a company rather than to the continuity of the business. This could mean rating elimination filtering in companies with low operating profitability.

From the short side we notice that the plain value short portfolio seems to be the worst option to choose as the short portfolio, since it is in fact able to create high returns comparing to other short portfolios (19.1% annually compared to 11.6% – 12.5% in the distress risk eliminated portfolios). This might be due to plain value shorting valuable companies with good business strategies that are worth their high valuation. On the other hand, the short side of the rating and Z-score value portfolios seem to perform quite equally (rating 11.6% and Z-score 12.5% mean returns and 12.7% and 13.0% volatilities). Therefore it seems that the rating elimination is able to collect the high distress risk glamour stocks in the short portfolio, whereas it might not work at choosing the low distress risk value stocks in the long side.

Going into the long/short portfolios (cumulative returns are illustrated in figure 4), it does not seem meaningful to keep on analysing the rating long/short portfolio returns, since the return of this portfolio is around zero. The rating based value long/short portfolio annualized mean return is 1.4% and the cumulative 10Y return is 10.3% which seems to be merely fluctuation around zero than continuous positive return. However, one thing to note here is that the rating based distress measure might create a good short portfolio for some strategy going forward, since as stated it provides similar results as the Z-score short portfolio. For the Altman Z portfolio, it seems that the distress risk elimination is able to add most value in the short portfolio selection noticing the lower returns of the Altman Z short portfolio comparing with the plain value short portfolio (12.5% vs. 19.1% annually). It also seems that the Altman Z long portfolio is able to enhance the value strategy by decreasing the volatility of the long side return (17.5% vs. 22.1% annually).

Figure 3: Cumulative returns of value strategy long and short portfolios



In the figure above we can see the long and short portfolio returns individually for the plain value as well as the distress risk eliminated portfolios with both Altman Z and rating cutoffs. The returns are calculated as being long in the long portfolios and short in the short portfolios. The plain value long portfolio includes lowest 20 P/B stocks and the short portfolio highest 20 P/B stocks. Similarly Rating and Z-Score long portfolios include 20 lowest P/B stocks with either Z-Score over 5 or Rating better than A+ and the short portfolios include 20 highest P/B stocks with either Z-score lower than 2.3 or rating lower than BBB. All the portfolios are equally weighted and rebalanced monthly.

The Sharpe ratios in Table 10 are calculated as being long in all of the individual portfolios. Looking into the Sharpe ratios for plain value, Altman Z value and rating value long and short portfolios shows us that the Z-score value long portfolio creates the highest Sharpe ratio (1.39 vs. second highest plain value long at 1.18). We can also see that the rating and Altman Z short portfolios perform quite equally when comparing with the Sharpe ratios (0.91 and 0.96). Furthermore the rating long portfolio provides the lowest Sharpe ratio (0.57), and therefore it seems that it is not meaningful to keep on analysing the long/short value portfolio with rating cutoffs. Lastly, the plain value short portfolio Sharpe ratio is high at least considering it to be used as a short portfolio (1.09 vs. 1.18 for the similar long portfolio).

These information indicate that the Altman Z cutoffs are able to create value for both the long and short portfolios, whereas the rating short portfolio could add value that the rating long portfolio would then destroy. The higher Sharpe ratio in the Altman Z long portfolio comparing to the plain value long portfolio is due to lower volatility (17.5% vs. 22.1%), whereas the Altman Z and rating short portfolio lower Sharpe ratios compared to the plain value short portfolio seem to be due to lower mean returns (11.6% and 12.5% vs. 19.1%). Lastly in these results we see that the plain value short portfolio seems to be quite a poor option as a short portfolio, since it is able to provide quite high Sharpe ratios (1.09) and returns (19.1% annually).

Table 10: Sharpe ratios for value strategy long and short portfolios

In the table below we can see the Sharpe ratios of plain value long and short portfolios as well as long and short value portfolios with Altman Z and Rating cutoffs when taking long positions in all of these portfolios individually. The portfolio selection is similar as described in figure 3 explanation.

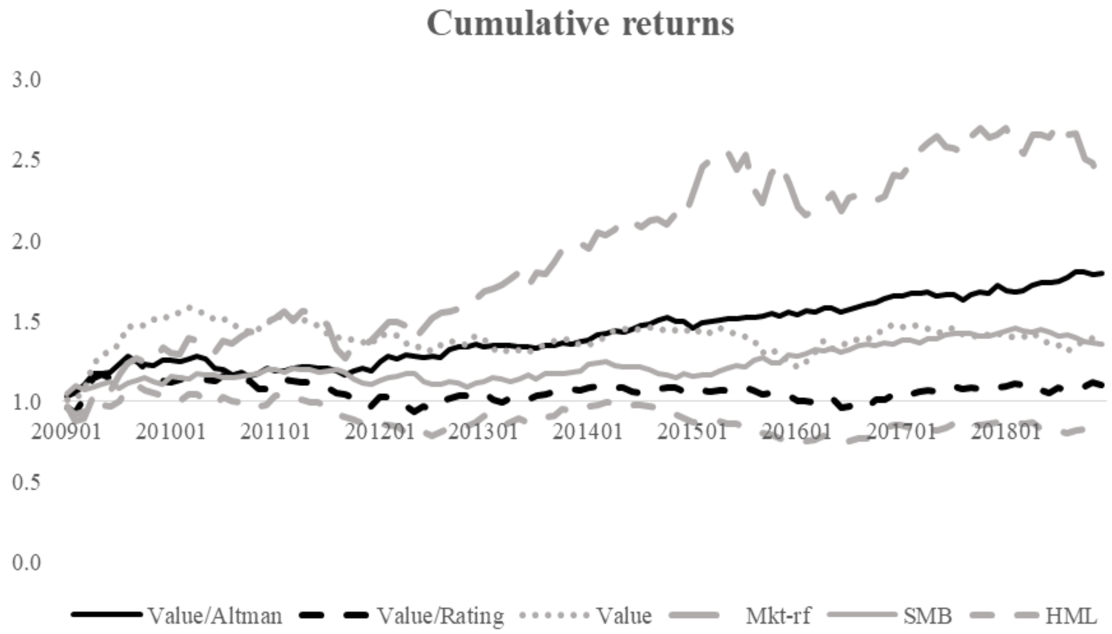
	Rating/Long	Rating/Short	Z-score/Long	Z-score/Short	Value/Long	Value/Short
Sharpe ratio	0.57	0.91	1.39	0.96	1.18	1.09

Figure 4 below illustrates the cumulative returns of the distress risk eliminated value long/short portfolios and a few chosen benchmark portfolios. These portfolios are plain value, Mkt-RF, SMB and HML respectively. All the other portfolios are long/short but Mkt-RF is long only. We can see that on a time period from 1/2009 to 12/2018 the returns of the distress risk (Z-score) eliminated long/short portfolio (6.0% annually) are second highest within this group of portfolios only second to the Mkt-RF long portfolio (9.4%). However, the Mkt-RF portfolio would have a more meaningful comparison against the long portfolios in figure 3, where we can see that all value long portfolios are able to beat the market portfolio. Further in figure 4 we can see that the return of the Altman Z value portfolio is very stable (5.7% annualized volatility), and persists all the way to the end of 2018 (5.5% annual return during 2014 – 2018). When comparing with the closest benchmarks, namely SMB and plain value portfolios, we can see that the volatility of these benchmarks is considerably higher (around 9% annually) and in fact from 2017 onwards both the SMB and plain value portfolio returns have decreased whereas the distress risk eliminated value portfolio keeps performing well (annualized mean return 4.2% vs. -3% for value and 0% for SMB after 2017). Therefore it seems that the plain value anomaly might be fading away, but with distress risk elimination the anomaly can still be found. However the time period we monitor here is too short to determine whether the plain value anomaly is really fading or whether this is just some time varying change we see. Moreover we notice that the rating value long/short portfolio cumulative returns are very low for the whole period (1.4% annually), merely fluctuating around zero.

In table 11 we observe the Sharpe ratios of the Altman Z value portfolio and the same benchmark portfolios as earlier, namely plain value, Mkt-RF, SMB and HML. We can see that the annualized Sharpe ratio of the Altman Z value portfolio is the highest within the group

(1.09) followed by the market portfolio (0.7) and SMB (0.57). Furthermore we can see that the Sharpe ratio of the plain value long/short portfolio is only 0.39, and therefore it seems that the distress risk elimination enhances the value strategy in our sample.

Figure 4: Time series of cumulative returns for distress risk eliminated value strategy (Value/Altman and Value/Rating) and chosen benchmark portfolios



In the above figure one can see the time series of cumulative returns for distress risk eliminated value long/short portfolios (Value/Altman and Value/Rating) as well as chosen benchmark portfolios. The benchmark portfolios are the European Small-Minus-Big portfolio return (SMB), the European High-Minus-Low portfolio return (HML) from Kenneth French data library, and the European market portfolio return in excess of the risk-free return (Mkt-rf) as well as a value investing strategy without distress risk elimination (Value) from the EuroStoxx600 data. The time period is from 01/2009 to 12/2018. The market portfolio is a value weighted long portfolio of EuroStoxx600 stocks and the plain value portfolio is an equally weighted long/short portfolio long 20 lowest P/B stocks and short 20 highest P/B stocks with monthly rebalancing. SMB and HML portfolios are computed similarly as documented in Fama and French (1993).

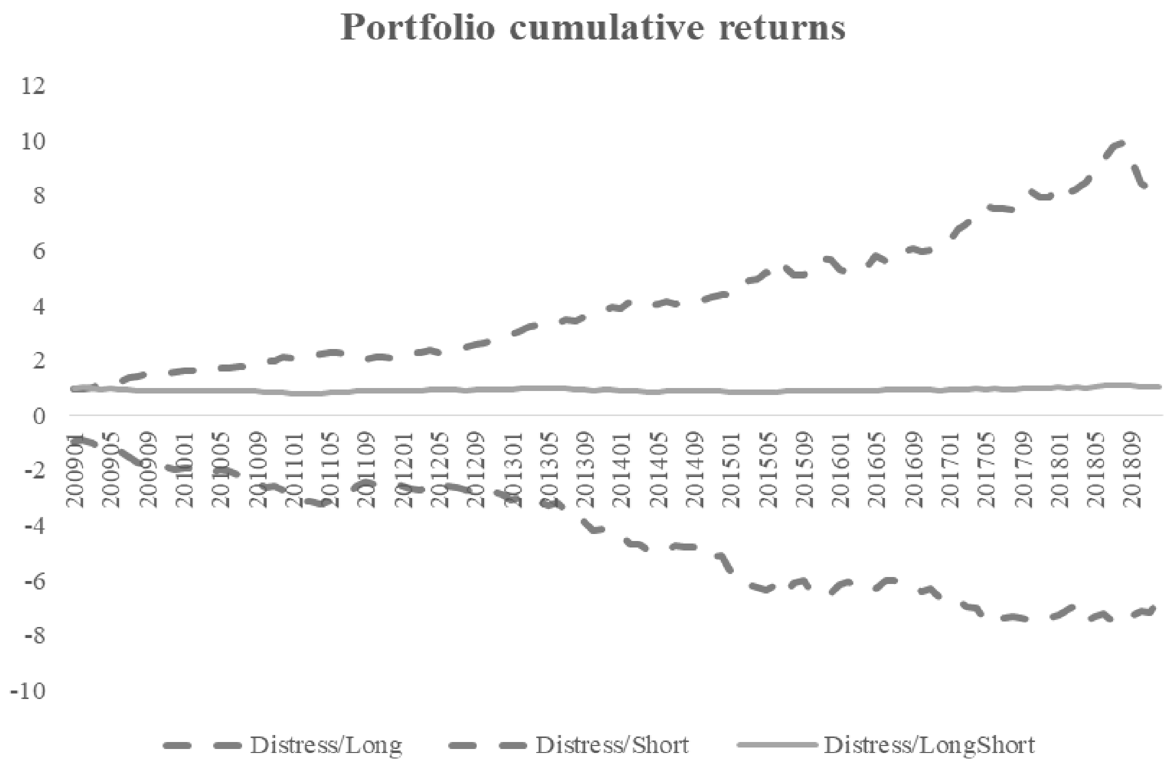
Table 11: Sharpe ratios of distress risk eliminated value strategy (Value/Altman) and chosen benchmark portfolios

The table below represents the annualized Sharpe ratios of the distress risk eliminated value strategy portfolio (Altman Z) and chosen benchmark portfolios. These are the same portfolios as specified above in figure 4 excluding the rating portfolio since it does not seem to yield returns different from zero.

	Value/Altman	Value	Mkt-rf	SMB	HML
Sharpe ratio	1.06	0.39	0.70	0.53	-0.17

In figure 5 below we see the cumulative returns of the long, short and long/short plain distress risk portfolios where the distress risk is proxied by Altman Z. Top 20 Altman Z companies are chosen in the long portfolio and bottom 20 in the short portfolio each month. In the figure we can see that the scale of the returns on long and short portfolios are similar (21.7% and 20.6%), and that the long/short portfolio returns are close to zero (0.5% annually) for the whole period. Therefore a distress risk anomaly does not seem to appear implying that distress risk is on average priced correctly in stocks. However we can see that the volatility patterns of the long and short portfolios are not similar, and that the volatility of the short side portfolio is in fact larger (in fact the volatilities are 12.8% for the long portfolio and 17.2% for the short portfolio). This means that the distress risk long/short factor portfolio might reveal loadings to distressed stocks after all. Furthermore the result implies that distress risk elimination might decrease return volatilities, which we saw already in figure 3 in distress risk eliminated value long portfolio return. Therefore it is meaningful to add this distress risk factor portfolio in the regressions explaining the dependent portfolio returns.

Figure 5: Cumulative returns of plain distress risk long, short and long/short portfolios, distress risk proxied by Altman Z



In the figure above we can see the cumulative returns of the long, short and long/short plain distress risk portfolios for 2009 - 2018. The long portfolio invests in 20 highest Altman Z stocks, and short portfolio in lowest 20 Altman Z stocks. The long/short portfolio includes both of these legs. All the portfolios are equally weighted and rebalanced monthly.

Table 12 summarizes the OLS regression results of the distress risk eliminated value long/short portfolio, where the distress risk is proxied with Altman Z. The factor portfolios utilized are Mkt-RF, SMB, HML, MOM, RMW, CMA and the Distress risk factor portfolio. We can see that the adjusted R-squared is between 17% and 24% depending on the model, and the portfolio loads mostly on the SMB and Mkt-RF portfolios. Furthermore we can see that the HML loading is insignificant and that the Distress risk factor loading is positive, meaning that there are less distressed companies in the long portfolio compared to the short side. Lastly we notice that the alpha is significant and around 4-5% annually.

The significant alpha suggests that the distress risk elimination might enhance the value strategy beyond what the distress risk factor portfolio is able to explain. The insignificant loading on the HML factor is a bit surprising since the portfolio selection is partly based on the B/M figure behind the HML portfolio as well. Furthermore the loadings on SMB and HML portfolios suggest that the portfolio return is rather explained by the size factor than the value factor. This implies that it is easier to find small companies that are undervalued than large companies with low valuations. This sounds intuitive and is in line with Vassalou and Xing (2004). Furthermore the positive loading on the market factor implies higher betas in the long portfolio compared to the short, which is in line with Petkova and Zhang (2005).

Overall it seems that the distress risk exposure is unable to explain all of the value anomaly, and that the distress risk elimination seems to enhance the value strategy. This contradicts with the risk-factor theory of Fama and French (1993) and supports mispricing theory of Lakonishok, Shleifer and Vishny (1994). Furthermore this result suggests that it is possible to yield value strategy returns without including excess distress risk in the portfolio.

Table 12: Results for the linear regressions explaining the return of the distress risk eliminated long/short value portfolio, distress risk proxied by Altman Z

The table below contains the OLS regression results explaining the returns of the distress risk eliminated long/short value portfolio during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks with Altman Z-score higher than 5 and short positions in highest 20 P/B stocks with Altman Z-score lower than 2.3. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

	Dependent variable:					
Independent	Return of the distress risk controlled long/short value portfolio					
variables	(1)	(2)	(3)	(4)	(5)	(6)
α	3.91**	4.91***	4.28**	4.78**	4.03**	4.66**
	(2.348)	(2.763)	(2.028)	(2.258)	(2.364)	(2.263)
Mkt-RF	0.14***	0.11***	0.09**	0.09*	0.14***	0.09**
	(3.513)	(2.668)	(2.113)	(1.904)	(3.635)	(2.02)
SMB	0.29***	0.26***	0.25***	0.24***	0.26***	0.22**
	(3.599)	(3.287)	(2.996)	(2.862)	(3.219)	(2.573)
HML	0.09	0.02	0.22	0.15	0.16**	0.24*
	(1.515)	(0.334)	(1.539)	(1.067)	(2.11)	(1.734)
MOM		-0.1**		-0.07		-0.09*
		(-2.283)		(-1.657)		(-1.934)
RMW			0.04	0.05		0.11
			(0.202)	(0.233)		(0.5)
CMA			-0.35**	-0.25		-0.21
			(-2.141)	(-1.59)		(-1.336)
Distress					0.16	0.2*
					(1.467)	(1.906)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	16.9%	20.5%	20.2%	21.1%	18.5%	23.8%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

In table 13 we can see the OLS regression results where the Mkt-RF, SMB, HML, MOM, RMW, CMA and Distress risk factor portfolios explain the return of the plain value portfolio. Here the adjusted R-squared is between 40% and 65%, which is considerably higher than for the distress risk eliminated portfolio. Furthermore we can see that the alphas are significant in only the models including the Momentum factor where the MOM factor loading is significantly negative. However, the alphas are still positive in all the models, between 1.2% and 5.5%. We can also see that the SMB factor is still mostly significant, but so is the HML factor which seems to be the largest positive driver of this plain value return. Moreover we can see that the Distress risk factor loading is now negative which means that the portfolio loads on distressed stocks.

These results suggest that the HML and SMB factors are able to capture almost all of the return of this plain value portfolio. The HML factor seems to be the largest positive driver of the portfolio return, which is not surprising since the B/M figure is the basis in constructing both of these portfolios. Furthermore the plain value strategy seems to invest in the momentum strategy inversely. This again is in line with Lakonishok, Shleifer and Vishny (1994) and Agarwal and Taffler (2008). It also seems that the market betas are on average higher in the long portfolio comparing to the short portfolio, which is also found by Petkova and Zhang (2005). Moreover it seems that the value strategy includes more distress risk in the long portfolio in comparison with the short portfolio. This is in line with Fama and French (1993) risk-based explanation for the value anomaly. Lastly, the factor portfolios explain up to 65% of the value long/short portfolio return which can be considered quite high especially when comparing with the distress risk eliminated value portfolio R-squared around 20%.

Overall these results support the risk factor theory by Fama and French (1993) at least to some extent; the value strategy long portfolio includes more distressed stocks than the short portfolio, which might justify the high returns of the value strategy.

Table 13: Results for the linear regressions explaining the return of the plain value long/short portfolio

The below table contains the linear regression results explaining the returns of the plain value long/short portfolio during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks and short positions in highest 20 P/B stocks. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month bill yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

	Dependent variable:					
Independent	Return of the plain long/short value portfolio					
variables	(1)	(2)	(3)	(4)	(5)	(6)
α	2.18	5.54***	1.21	3.78**	2.06	3.78**
	(0.954)	(2.868)	(0.541)	(2.149)	(0.947)	(2.252)
Mkt-RF	0.16*	0.06	0.11*	0.07*	0.16*	0.07*
	(1.871)	(1.373)	(1.869)	(1.836)	(1.9)	(1.78)
SMB	0.23*	0.12	0.21*	0.18**	0.27**	0.2**
	(1.684)	(1.305)	(1.79)	(2.012)	(2.061)	(2.273)
HML	0.56***	0.32***	0.87***	0.47***	0.44***	0.4***
	(7.074)	(4.773)	(4.237)	(4.451)	(4.36)	(3.534)
MOM		-0.36***		-0.38***		-0.37***
		(-6.867)		(-7.773)		(-7.395)
RMW			0.34	0.37**		0.33**
			(1.508)	(2.424)		(2.15)
CMA			-0.42	0.14		0.12
			(-1.448)	(0.914)		(0.769)
Distress					-0.29**	-0.14
					(-2.123)	(-1.511)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	41.6%	61.5%	44.7%	62.5%	43.9%	62.9%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

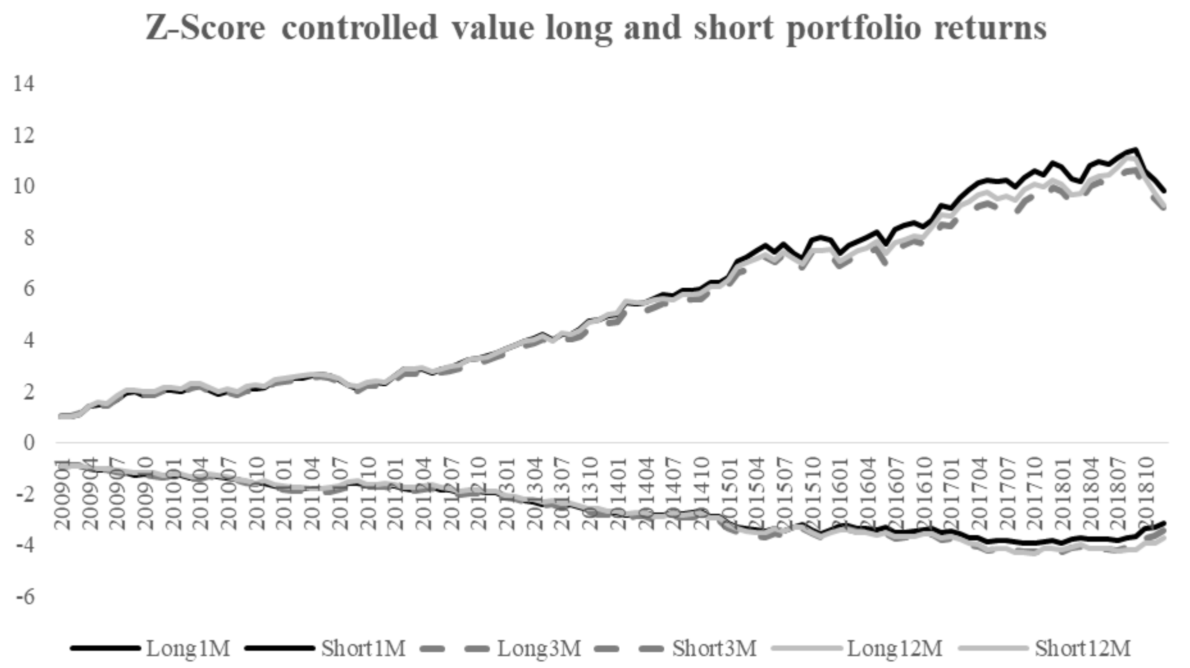
When comparing the results of the distress risk eliminated value and plain value strategies we notice that both strategies load on the market and size factors positively with similar scale. These results suggest that the value strategy invests in high market beta small companies, whereas it tends to be short larger companies with lower market betas. These findings are in line with Petkova and Zhang (2005) and Vassalou and Xing (2004). Moreover the CMA and RMW factors don't seem to explain the portfolio returns in either case.

Looking into the differences between plain value and distress risk eliminated value it seems that the plain value strategy loads more negatively on the momentum factor which means that it seems to choose momentum short stocks in the long portfolio and vice versa, whereas this phenomenon is less significant in the distress risk eliminated portfolio. Also, in line with Fama and French (1993), the plain value long/short portfolio seems to invest in distressed companies which is indicated by the Distress risk factor portfolio loading. However in contradiction with Fama and French (1993) and in line with Lakonishok, Shleifer and Vishny (1994) the distress risk eliminated value strategy is still able to produce high returns without the elevated distress risk exposure. This is indicated by the Distress risk factor portfolio loadings and the significant positive alphas (4-5% annually) as well as the raw return (6% annually) of the distress risk eliminated value long/short portfolio. It also seems that the chosen traditional factor portfolios are able to explain the returns of the plain value portfolio quite well, whereas they fail in explaining the distress risk eliminated value portfolio returns. This is implied by the adjusted R-squared of up to 65% with the plain value portfolio and only around 20% with the distress risk eliminated value portfolio.

5.3 Distress risk eliminated value strategy with longer holding periods

The distress risk measures mostly vary either quarterly or yearly depending on the reporting intervals of the company. This makes it so that with holding periods shorter than 3M (or 12M in some cases), the distress risk indicators don't usually change. However, the value measure (B/M or P/B) varies in relation to the market value of the stock, which means that there might be differences in the portfolio selection between rebalancing the portfolio monthly, quarterly or yearly. This subsection studies whether the results discussed in the above chapters look similar with different holding periods. Below figures and tables compare results between 1M (baseline), 3M and 12M holding periods. This analysis adds value to the previous studies where the rebalancing has been done annually (Friewald, Wagner and Zechner, 2014, Griffin and Lemmon, 2002 and Piotroski, 2000 to name a few).

Figure 6: Cumulative returns of distress risk eliminated value long and short portfolios with holding periods of 1M, 3M and 12M



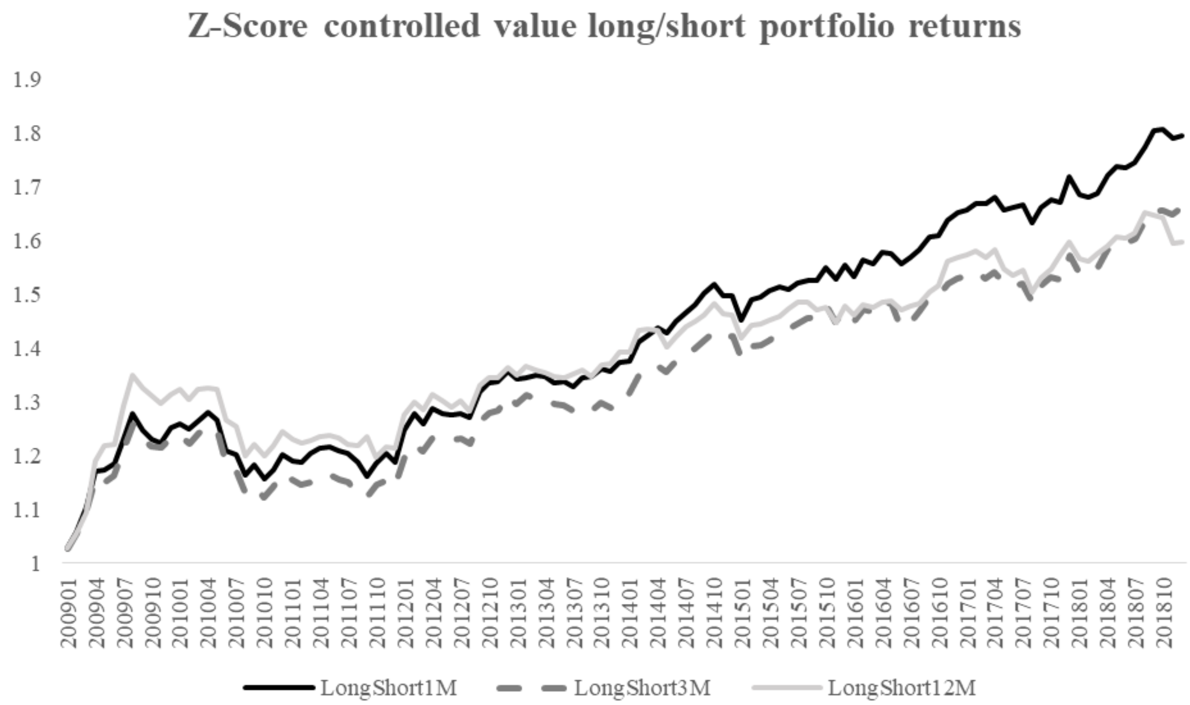
In the above figure one can see the time series of cumulative returns for distress risk eliminated value long and short portfolios with holding periods of 1M, 3M and 12M. The time period is from 01/2009 to 12/2018. The returns are calculated as being long in the long portfolios and short in the short portfolios. The long portfolios include 20 lowest P/B stocks with Z-Score over 5 and the short portfolios include 20 highest P/B stocks with Z-score lower than 2.3. The portfolios are equally weighted and rebalanced either monthly, quarterly or annually.

Table 14: Sharpe ratios of distress risk eliminated value long and short portfolios with holding periods of 1M, 3M and 12M

The table below represents the annualized Sharpe ratios of distress risk eliminated value long and short portfolios with holding periods of 1M, 3M and 12M. The time period is from 01/2009 to 12/2018. The Sharpe ratios are calculated as taking long positions in all of these portfolios individually. The portfolio selection is similar as described in figure 6 explanation.

	Long1M	Short1M	Long3M	Short3M	Long12M	Short12M
Sharpe ratio	**1.39**	**0.96**	1.35	1.02	1.36	1.07

Figure 7: Cumulative returns of distress risk eliminated value long/short portfolios with holding periods of 1M, 3M and 12M



In the above figure one can see the time series of cumulative returns for distress risk eliminated value long/short portfolios with holding periods of 1M, 3M and 12M. The time period is from 01/2009 to 12/2018. The long portfolios include 20 lowest P/B stocks with Z-Score over 5 and the short portfolios include 20 highest P/B stocks with Z-score lower than 2.3. The long/short portfolio includes both of these legs. The portfolios are equally weighted and rebalanced either monthly, quarterly or annually.

Table 15: Sharpe ratios of distress risk eliminated value long/short portfolios with holding periods of 1M, 3M and 12M

The table below represents the annualized Sharpe ratios of distress risk eliminated long/short portfolios with holding periods of 1M, 3M and 12M. The time period is from 01/2009 to 12/2018. The portfolio selection is similar as described in figure 7 explanation.

	LongShort1M	LongShort3M	LongShort12M
Sharpe ratio	**1.06**	0.92	0.77

Table 16: Results of the linear regressions explaining the return of the distress risk eliminated value long/short portfolio with 3M holding period

The below table contains the linear regression results explaining the returns of the distress risk eliminated value long/short portfolio with 3-month holding periods during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks with Altman Z-score higher than 5 and short positions in highest 20 P/B stocks with Altman Z-score lower than 2.3. The portfolio is equally weighted and rebalanced quarterly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

	Dependent variable:					
Independent	Return of the distress risk controlled long/short value portfolio, 3M holding period					
variables	(1)	(2)	(3)	(4)	(5)	(6)
α	3.29*	4.16**	3.66*	4.03*	3.29*	3.91*
	(1.911)	(2.372)	(1.693)	(1.902)	(1.899)	(1.846)
Mkt-RF	0.13***	0.1**	0.08*	0.08*	0.14***	0.09**
	(3.232)	(2.525)	(1.921)	(1.733)	(3.473)	(2.032)
SMB	0.31***	0.28***	0.26***	0.26***	0.28***	0.23***
	(3.927)	(3.74)	(3.337)	(3.214)	(3.45)	(2.95)
HML	0.11*	0.04	0.23	0.16	0.19***	0.26*
	(1.762)	(0.689)	(1.574)	(1.165)	(2.761)	(1.863)
MOM		-0.1**		-0.06		-0.08*
		(-2.11)		(-1.51)		(-1.968)
RMW			0.03	0.04		0.1
			(0.132)	(0.157)		(0.434)
CMA			-0.34**	-0.25*		-0.2
			(-2.187)	(-1.746)		(-1.307)
Distress					0.21**	0.24**
					(2.072)	(2.298)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	19.3%	22.8%	23.5%	24.7%	23.1%	29.1%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

Table 17: Results for the linear regressions explaining the return of the distress risk eliminated value long/short portfolio with 12M holding period

The below table contains the linear regression results explaining the returns of the distress risk eliminated value long/short portfolio with 12-month holding periods during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks with Altman Z-score higher than 5 and short positions in highest 20 P/B stocks with Altman Z-score lower than 2.3. The portfolio is equally weighted and rebalanced annually. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

Independent variables	Dependent variable: Return of the distress risk controlled long/short value portfolio, 12M holding period (1)	(2)	(3)	(4)	(5)	(6)
α	2.67	4.03**	2.67	3.41*	2.67	3.29*
	(1.503)	(2.171)	(1.257)	(1.682)	(1.612)	(1.747)
Mkt-RF	0.13**	0.09*	0.09*	0.08*	0.15**	0.1**
	(2.135)	(1.978)	(1.858)	(1.725)	(2.476)	(2.477)
SMB	0.36***	0.32***	0.34***	0.33***	0.33***	0.29***
	(3.864)	(4.019)	(3.861)	(3.849)	(3.278)	(3.596)
HML	0.12*	0.03	0.29*	0.15	0.24***	0.29**
	(1.879)	(0.393)	(1.678)	(1.013)	(3.671)	(2.279)
MOM		-0.14**		-0.13**		-0.16***
		(-2.367)		(-2.153)		(-2.958)
RMW			0.12	0.13		0.21
			(0.541)	(0.623)		(1.121)
CMA			-0.31	-0.13		-0.07
			(-1.47)	(-0.707)		(-0.45)
Distress					0.42***	0.48***
					(3.702)	(4.992)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	17.2%	23.1%	19.2%	22.6%	27.6%	36.2%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

In figure 6 and table 14 we can see that the raw returns and Sharpe ratios are the highest in the 1M holding period long portfolio (24.5% annual return, 1.39 Sharpe ratio) and the lowest in the 1M holding period short portfolio (12.5% annual return, 0.95 Sharpe ratio). These results imply that the 1-month rebalancing adds value to the distress risk eliminated value strategy comparing to longer holding periods and that this outperformance comes from both the long and short portfolios. Results in figure 7 and table 15 further argue in favour of this interpretation, since the returns are the highest and most stable with the 1-month holding period long/short portfolio (6.0% return and 5.7% volatility annually). Also the Sharpe ratio of this portfolio is the highest within the calculated long/short portfolios with different holding periods (1.06).

Furthermore comparing tables 16 and 17 with table 12 shows us that the alphas decrease from significant 4 - 5% with 1M holding period to mostly insignificant 2.5 - 4% with 12M holding period. Furthermore it looks that the distress risk factor loading increases with the holding period (0.2 with 1M vs. 0.5 with 12M), as do the loadings to SMB, HML and MOM, whereas the market factor loading remains the same. Also the R-squared increases from around 20% with 1M holding period to as high as 37% with the 12M holding period. However, regarding the alphas a similar decrease in the plain value portfolio is found when rebalancing the portfolio only quarterly or annually. These plain value portfolio alphas are zero. The plain value regression results are not reported in my thesis, since they are not in the scope of the study.

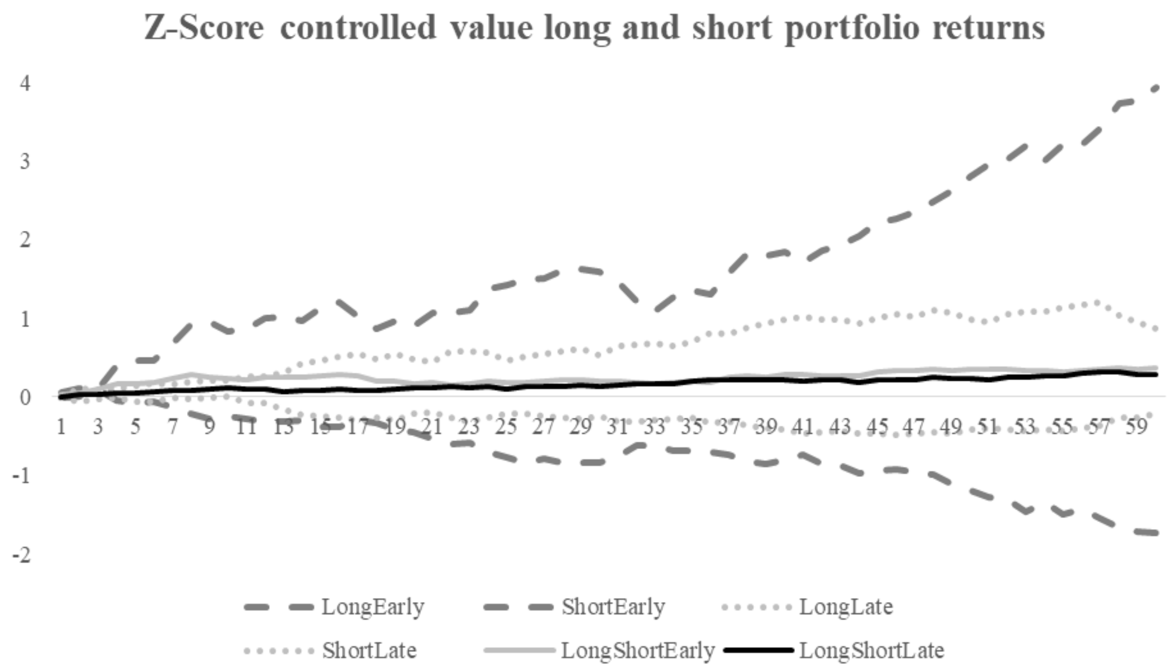
All in all it seems that the 1-month holding period provides the highest and most stable raw returns (6% vs. 5% returns), as well as the highest risk-adjusted returns (4 - 5% alphas compared to 2.6 – 4%). This might be due to faster reaction to either new accounting information or new value indications from the market. Furthermore it seems that the longer the holding period is, the more the returns are explained by the factor portfolios, namely SMB, HML and MOM. This might be due to getting less value from reacting slower to distress risk indications, and therefore loading more on the traditional factors. Lastly, it seems that the outperformance of the 1M holding period comes from both long and short side portfolios.

5.4 Distress risk eliminated value strategy development in time

When looking at figure 4 it seems that the returns of the distress risk eliminated value long/short portfolio have been even more stable during the last years of the sample period comparing to the first years and especially comparing with the nearest benchmark (SMB and plain value) portfolio returns. Looking into the late performance we notice that the returns of the distress risk eliminated value long/short portfolio are still 4.2% annually during 2017 and 2018, whereas

SMB and plain value returns are 0% and -3% during the same period. Given this decrease of returns in the traditional factor portfolios, this section studies whether the raw returns and factor loadings of the distress risk eliminated value portfolio look similar during the first five years (2009 – 2013) and the last five years (2014 – 2018) of the observation period. Below figures and tables compare the results between the first and last five years of the sample period.

Figure 8: Cumulative returns of distress risk eliminated value long, short and long/short portfolios during 2009 – 2013 and 2014 - 2018



In the above figure one can see the time series of cumulative returns for distress risk eliminated value long, short and long/short portfolios during 2009 – 2013 (Early) and 2014 – 2018 (Late) separately. The returns are calculated as being long in the long portfolios and short in the short portfolios. The long portfolios include 20 lowest P/B stocks with Z-Score over 5 and the short portfolios include 20 highest P/B stocks with Z-score lower than 2.3. The long/short portfolios include both of these legs. All of the portfolios are equally weighted and rebalanced monthly.

Table 18: Sharpe ratios of distress risk eliminated value long, short and long/short portfolios during 2009 – 2013 and 2014 – 2018

The table below represents the annualized Sharpe ratios of distress risk eliminated value long, short and long/short portfolios during 2009 – 2013 (Early) and 2014 – 2018 (Late) separately. The portfolio selection is similar as described in figure 8 explanation.

	LongEarly	ShortEarly	LongLate	ShortLate	LongShortEarly	LongShortLate
Sharpe ratio	1.63	1.51	1.05	0.38	**0.95**	**1.09**

Table 19: Results for the linear regressions explaining the return of the distress risk eliminated value portfolio during 2009 – 2013

The below table contains the linear regression results explaining the returns of the distress risk eliminated long/short value portfolio during 2009 – 2013. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks with Altman Z-score higher than 5 and short positions in highest 20 P/B stocks with Altman Z-score lower than 2.3. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

Independent variables	Dependent variable: Return of the distress risk controlled long/short value portfolio, first 5Y in sample (1)	(2)	(3)	(4)	(5)	(6)
α	1.45	2.67**	1.09	1.33*	1.69	1.57
	(0.426)	(2.171)	(1.257)	(1.682)	(0.567)	(0.426)
Mkt-RF	0.24***	0.21***	0.18**	0.18**	0.26***	0.19**
	(4.307)	(3.213)	(2.28)	(2.21)	(4.381)	(2.272)
SMB	0.4***	0.35***	0.39***	0.37***	0.39***	0.36***
	(3.641)	(3.006)	(3.299)	(3.094)	(3.524)	(3.003)
HML	-0.02	-0.09	0.22	0.16	0.08	0.29
	(-0.312)	(-1.042)	(1.099)	(0.826)	(0.817)	(1.575)
MOM		-0.09*		-0.05		-0.07
		(-1.739)		(-1.069)		(-1.269)
RMW			0.23	0.24		0.27
			(0.668)	(0.719)		(0.864)
CMA			-0.38	-0.28		-0.28
			(-1.52)	(-1.071)		(-1.081)
Distress					0.24	0.3*
					(1.353)	(1.784)
no. of obs.	60	60	60	60	60	60
Adjusted R^2	22.4%	24.9%	26.5%	26.0%	23.7%	29.0%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

Table 20: Results for the linear regressions explaining the return of the distress risk eliminated value portfolio during 2014 – 2018

The below table contains the linear regression results explaining the returns of the distress risk eliminated long/short value portfolio during 2014 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks with Altman Z-score higher than 5 and short positions in highest 20 P/B stocks with Altman Z-score lower than 2.3. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

Independent variables	Dependent variable: Return of the distress risk controlled long/short value portfolio, last 5Y in sample (1)	(2)	(3)	(4)	(5)	(6)
α	4.53**	5.28***	5.28***	5.79***	4.53**	5.66***
	(2.511)	(2.836)	(2.797)	(3.031)	(2.493)	(2.989)
Mkt-RF	0.09*	0.07	0.07	0.06	0.08*	0.06
	(1.755)	(1.245)	(1.107)	(0.939)	(1.662)	(0.914)
SMB	0.2*	0.21**	0.14	0.16	0.14	0.12
	(1.92)	(2.068)	(1.408)	(1.618)	(1.205)	(1.084)
HML	0.15**	0.1	0.1	0.05	0.19**	0.11
	(1.985)	(1.375)	(0.747)	(0.332)	(2.088)	(0.72)
MOM		-0.09		-0.07		-0.09
		(-1.031)		(-0.691)		(-0.852)
RMW			-0.18	-0.18		-0.12
			(-0.959)	(-0.974)		(-0.651)
CMA			-0.19	-0.14		-0.11
			(-1.177)	(-0.722)		(-0.546)
Distress					0.14	0.13
					(0.962)	(0.967)
no. of obs.	60	60	60	60	60	60
Adjusted R^2	7.3%	7.4%	6.8%	6.0%	8.6%	6.7%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

In figure 8 and table 18 we can see that the long/short strategy has performed a bit better during 2009 – 2013 compared to 2014 - 2018 measured by raw returns (6.6% vs. 5.0%), but during the later period the returns have been more stable and thus the Sharpe ratio has been a bit higher (1.09 vs. 0.95). Furthermore we can see that during the first period both the long and short portfolios have had highly positive returns (34.4% long and 21.1% short), whereas during the later period the returns have been only moderately positive (13.3% long and 4.3% short). This is in line with the overall market return during those periods, and this result implies that the distress risk eliminated value long/short strategy works in both highly positive and moderately positive return environments. This is quite intuitive since we are discussing about a long/short portfolio where the possible anomalous returns should persist regardless of the overall market return. Lastly we can see that the Sharpe ratios as well as returns and volatilities vary a lot more in the single long and short portfolios in comparison with the long/short portfolios (long/short volatilities between 4.6% and 6.9%, whereas and long and short portfolio volatilities are between 12.7% and 21.0%). This further indicates that the long/short portfolio returns are anomalous whereas the single long and short portfolio returns are highly dependent on the current market environment.

Tables 19 and 20 compare the risk-adjusted returns of the distress risk eliminated value strategy. At first we notice that during both time periods the alphas are positive, but only during the last five years they are mostly significant. This might be partly due to the limited amount of observations in the subsamples, but either way we can see that the alphas between the two time periods differ from each other, since they are between 4.5% and 6% annually during the later period and only 1 - 2.7% during the earlier period. Secondly we notice that the adjusted R-squared is below 9% in all models during 2014 – 2018, whereas they are between 20% and 30% during 2009 – 2013. This below 9% can be considered very low when we are discussing portfolio returns whereas the 30% is a bit more usual figure. The result implies that the models explain the distress risk eliminated value strategy returns during the earlier period to some extent, but the same factor portfolios are incapable of explaining the return during the later period. This result is further implied by the significances of the factor portfolio loadings, since in most models all the factor portfolio loadings are statistically insignificant during 2014 – 2018, whereas the market, SMB and distress risk factors are significant during 2009 – 2013. This indicates that that even when the traditional factor portfolios are not performing, the distress risk eliminated value portfolio keeps producing anomalous returns. Indications that support this result can also be seen in figure 4, where lately the market portfolio return has been very volatile, and the return of the SMB portfolio has been decreasing, whereas the distress risk eliminated value portfolio keeps performing during the same time period. When looking into the raw returns we can see that the returns of the distress risk eliminated value long/short portfolio are still positive at 4.2% annually during 2017 and 2018, whereas SMB and plain value returns are 0% and -3% during the same period arguing in favour of this interpretation.

So overall it seems that the distress risk eliminated value strategy works during the whole period, though a bit better later during 2014 -2018 measured by risk-adjusted returns. This implies that the strategy works in both highly positive and moderately positive return environments. Furthermore we notice that the risk-adjusted returns being higher during the later period seems to be due to distress risk eliminated value strategy still performing well when the factor portfolios (namely market and SMB) seem to be struggling with decreasing returns.

5.5 Result sensitivity altering value and distress risk cutoffs

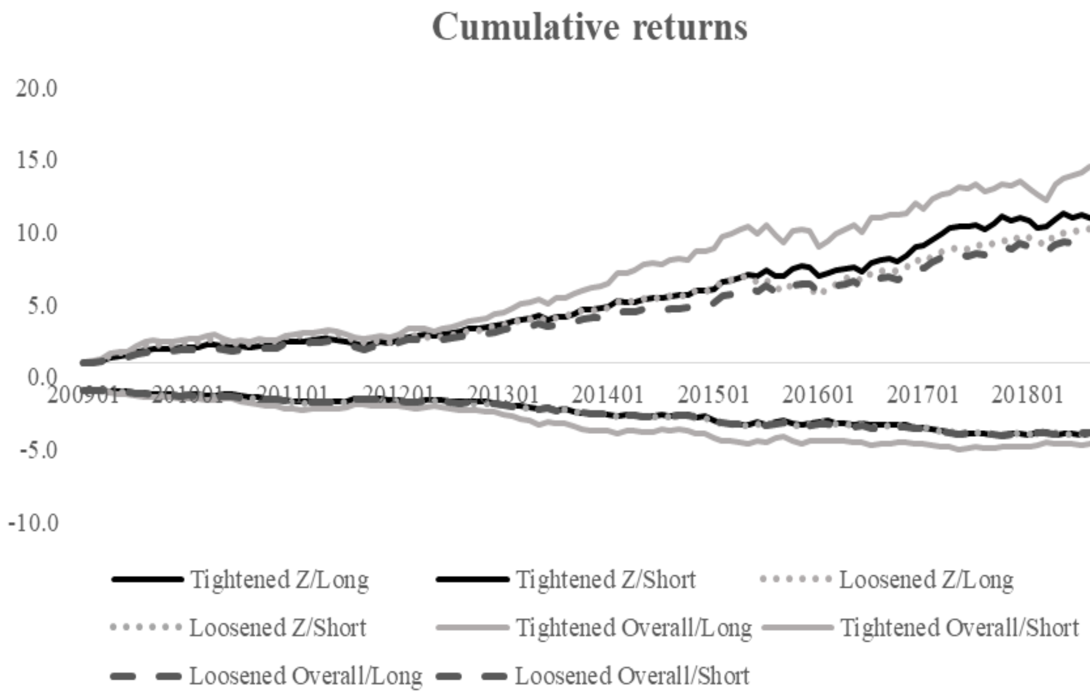
This subsection covers the results when altering the cutoffs for the portfolio selection. The Z-score limits are increased to 6 on the long side and decreased to 1.8 for more rigorous distress risk cutoff and later decreased to 3 on the long side and increased to 2.6 on the short side to make the cutoff a bit looser. Further the amount of companies is increased to 30 in both long and short portfolios as well as decreased to 10. Tightening the Z-score cutoff will simultaneously loosen the value cutoff (P/B) and vice versa, whereas tightening/loosening the overall portfolio selection will have an effect on the value cutoff only. The realized mean cutoffs for P/B can be seen in table 21 below. Furthermore figures 9 and 10 as well as tables 22 – 27 present the cumulative returns, Sharpe ratios and OLS regression results for these portfolios.

Table 21: Realized mean P/B cutoffs for portfolios with altered selection criteria

In the below table one can see the realized mean cutoffs for the distress risk eliminated value strategy where the Altman Z cutoff or amount of companies is altered from the baseline scenario. The Z-score thresholds are altered to 6 (long) and 1.8 (short) in the tightened Z portfolio and to 3 (long) and 2.6 (short) in the loosened Z portfolio. Moreover top or bottom 10 companies are chosen in both long and short portfolios in the tightened overall strategy based on P/B and baseline Z-score cutoffs of 5 (long) and 2.3 (short), and similarly 30 companies are chosen in the overall loosened portfolio.

Realized mean cutoffs for value		
	Long	Short
Tightened Z	2.21	2.66
Loosened Z	1.02	3.38
10 (2.5%) companies	0.98	4.38
30 (7.5%) companies	2.26	2.59

Figure 9: Cumulative returns of the distress risk eliminated value long and short portfolios with altered portfolio selection criteria



In the above figure one can see the time series of cumulative returns for distress risk eliminated value long and short portfolios during 2009 – 2018. The returns are calculated as being long in the long portfolios and short in the short portfolios. The altered Z-score long portfolios include 20 lowest P/B stocks with Z-Score either over 6 (tightened) or 3 (loosened) and the similar short portfolios include 20 highest P/B stocks with Z-score lower than either 1.8 (tightened) or 2.6 (loosened). The overall altered long portfolios include either 10 (tightened) or 30 (loosened) lowest P/B stocks with Z-Score over 5 and the similar short portfolios include 10 (tightened) or 30 (loosened) highest P/B stocks with Z-score lower than 2.3. All of the portfolios are equally weighted and rebalanced monthly.

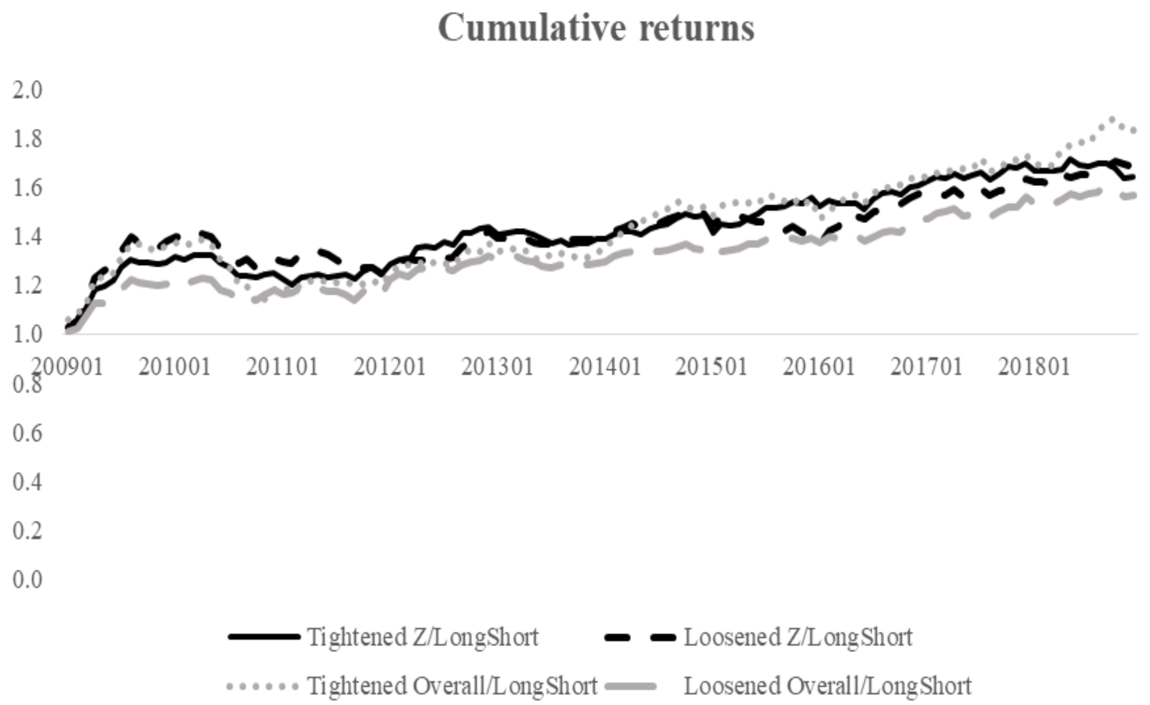
Table 22: Sharpe ratios of the distress risk eliminated value long and short portfolios with altered portfolio selection criteria

The table below represents the annualized Sharpe ratios of distress risk eliminated value long and short portfolios during 2009 – 2018. The portfolio selection is similar as described in figure 9 explanation. In the below naming of portfolios T means Tightened, starting L means loosened, Z means Z-score, O means Overall, /L means long portfolio and /S means short portfolio. As an example T Z/L means Tightened Z-Score Long portfolio and L O/S means Loosened Overall Short portfolio.

	T Z/L	T Z/S	L Z/L	L Z/S
Sharpe ratio	1.47	1.05	1.22	1.01

	T O/L	T O/S	L O/L	L O/S
Sharpe ratio	1.32	0.99	1.37	1.05

Figure 10: Cumulative returns of the distress risk eliminated value long/short portfolios with altered portfolio selection criteria



In the above figure one can see the time series of cumulative returns for distress risk eliminated long/short portfolios during 2009 – 2018. The altered Z long portfolios include 20 lowest P/B stocks with Z-Score either over 6 (tightened) or 3 (loosened) and the similar short portfolios include 20 highest P/B stocks with Z-score lower than either 1.8 (tightened) or 2.6 (loosened). The overall altered long portfolios include either 10 (tightened) or 30 (loosened) lowest P/B stocks with Z-Score over 5 and the similar short portfolios include 10 (tightened) or 30 (loosened) highest P/B stocks with Z-score lower than 2.3. The long/short portfolios include both the long and short leg of each strategy. The portfolios are equally weighted and rebalanced monthly.

Table 23: Sharpe ratios of the distress risk eliminated value long/short portfolios with altered portfolio selection criteria

The table below represents the annualized Sharpe ratios of distress risk eliminated long/short portfolios during 2009 – 2018. The portfolio selection is similar as described in figure 10 explanation. In the below naming of portfolios T means Tightened, starting L means loosened, Z means Z-score, O means Overall and /LS means long/short portfolio. As an example T Z/LS means Tightened Z-Score Long/Short portfolio and L O/LS means Loosened Overall Long/Short portfolio.

	T Z/LS	L Z/LS	T O/LS	L O/LS
Sharpe ratio	0.91	0.84	0.88	0.93

Table 24: Results for the linear regressions explaining the return of the distress risk eliminated value portfolio with tightened Z-score thresholds

The below table contains the linear regression results explaining the return of the distress risk eliminated value long/short portfolio during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks with Altman Z-score higher than 6 and short positions in highest 20 P/B stocks with Altman Z-score lower than 1.8. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

Independent variables	Dependent variable: Return of the distress risk controlled long/short value portfolio, tightened Z					
	(1)	(2)	(3)	(4)	(5)	(6)
α	2.67	3.91**	2.92	3.41*	2.8*	3.29*
	(1.612)	(2.154)	(1.629)	(1.897)	(1.701)	(1.896)
Mkt-RF	0.14***	0.11**	0.08*	0.07	0.15***	0.08**
	(2.713)	(2.265)	(1.751)	(1.58)	(3.001)	(2.069)
SMB	0.32***	0.28***	0.26***	0.26***	0.27***	0.22***
	(3.993)	(3.829)	(3.536)	(3.463)	(3.3)	(2.911)
HML	-0.04	-0.13*	0.17	0.09	0.07	0.24**
	(-0.595)	(-1.879)	(1.221)	(0.774)	(0.86)	(2.177)
MOM		-0.13**		-0.08		-0.1**
		(-2.066)		(-1.493)		(-2.055)
RMW			0.11	0.12		0.21
			(0.677)	(0.737)		(1.418)
CMA			-0.48***	-0.37***		-0.32**
			(-2.833)	(-2.7)		(-2.304)
Distress					0.28**	0.33***
					(2.15)	(2.964)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	12.2%	17.9%	20.2%	21.4%	18.5%	30.3%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

Table 25: Results for the linear regressions explaining the return of the distress risk eliminated value portfolio with loosened Z-score thresholds

The below table contains the linear regression results explaining the returns of the distress risk eliminated value long/short portfolio during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 20 P/B stocks with Altman Z-score higher than 3 and short positions in highest 20 P/B stocks with Altman Z-score lower than 2.6. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

	Dependent variable:					
Independent	Return of the distress risk controlled long/short value portfolio, loosened Z					
variables	(1)	(2)	(3)	(4)	(5)	(6)
α	3.66*	5.66***	3.41*	4.78**	3.66*	4.66**
	(1.858)	(2.692)	(1.664)	(2.318)	(1.886)	(2.32)
Mkt-RF	0.14***	0.08*	0.09*	0.08	0.15***	0.08
	(2.717)	(1.879)	(1.835)	(1.492)	(2.775)	(1.576)
SMB	0.24***	0.18**	0.21**	0.19**	0.23**	0.17*
	(2.62)	(2.105)	(2.233)	(2.091)	(2.407)	(1.825)
HML	0.22***	0.09	0.44**	0.23*	0.26***	0.31***
	(3.388)	(1.335)	(2.615)	(1.959)	(3.228)	(2.702)
MOM		-0.21***		-0.19***		-0.21***
		(-3.564)		(-4.053)		(-4.137)
RMW			0.17	0.19		0.24
			(0.916)	(1.087)		(1.411)
CMA			-0.38	-0.11		-0.08
			(-1.605)	(-0.64)		(-0.463)
Distress					0.09	0.17*
					(0.743)	(1.816)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	23.0%	35.4%	26.9%	35.4%	22.8%	36.7%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

Table 26: Results for the linear regressions explaining the return of the distress risk eliminated value portfolio with tightened overall portfolio selection

The below table contains the linear regression results explaining the returns of the distress risk eliminated value long/short portfolio during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 10 P/B stocks with Altman Z-score higher than 5 and short positions in highest 10 P/B stocks with Altman Z-score lower than 2.3. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

	Dependent variable:					
Independent	Return of the distress risk controlled long/short value portfolio, tightened overall					
variables	(1)	(2)	(3)	(4)	(5)	(6)
α	3.78	5.28**	4.28	5.16**	3.78*	5.03*
	(1.64)	(2.453)	(1.629)	(2.073)	(1.679)	(1.846)
Mkt-RF	0.18***	0.13***	0.12**	0.11**	0.18***	0.11**
	(3.202)	(2.753)	(2.363)	(2.223)	(3.294)	(2.404)
SMB	0.37***	0.33***	0.32***	0.31***	0.35***	0.28**
	(3.352)	(3.039)	(2.995)	(2.878)	(2.95)	(2.535)
HML	0.12*	0.01	0.27	0.14	0.19**	0.24
	(1.734)	(0.207)	(1.572)	(0.833)	(2.05)	(1.515)
MOM		-0.16***		-0.13**		-0.15***
		(-3.534)		(2.536)		(-2.785)
RMW			0.04	0.05		0.11
			(0.14)	(0.187)		(0.441)
CMA			-0.42**	-0.23		-0.2
			(-2.347)	(-1.258)		(-1.063)
Distress					0.16	0.22*
					(1.2)	(1.811)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	17.5%	23.4%	20.4%	23.1%	18.2%	25.0%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

Table 27: Results for the linear regressions explaining the return of the distress risk eliminated value portfolio with loosened overall portfolio selection

The below table contains the linear regression results explaining the returns of the distress risk eliminated value long/short portfolio during 2009 – 2018. The portfolio is formed from EuroStoxx600 as long positions in lowest 30 P/B stocks with Altman Z-score higher than 5 and short positions in highest 30 P/B stocks with Altman Z-score lower than 2.3. The portfolio is equally weighted and rebalanced monthly. Market portfolio is the value weighted EuroStoxx600 long portfolio, risk-free return is the US Treasury one-month yield and the Distress risk factor portfolio is conducted by choosing long 20 highest Altman Z stocks and short 20 lowest Altman Z stocks from the EuroStoxx600 weighting the portfolio equally and rebalancing monthly. Excluding the market portfolio the FF5 factor portfolios are the European factor portfolios from Kenneth French data library. Moreover as the distress risk factor portfolio is constructed as long positions in non-distressed stocks and short positions in distressed stocks, positive loading implies exposure towards non-distressed stocks and negative loading exposure to distressed stocks.

	Dependent variable:					
Independent	Return of the distress risk controlled long/short value portfolio, loosened overall					
variables	(1)	(2)	(3)	(4)	(5)	(6)
α	2.43*	3.29**	2.8	3.41*	2.55*	3.04*
	(1.683)	(2.095)	(1.639)	(1.682)	(1.718)	(1.821)
Mkt-RF	0.15***	0.12***	0.1***	0.08*	0.15***	0.1***
	(4.276)	(3.198)	(2.721)	(1.725)	(4.706)	(2.735)
SMB	0.28***	0.25***	0.24***	0.33***	0.25***	0.21***
	(4.156)	(3.751)	(3.41)	(3.849)	(3.824)	(2.94)
HML	0.03	-0.03	0.15	0.15	0.1	0.19
	(0.503)	(-0.571)	(1.199)	(1.013)	(1.547)	(1.64)
MOM		-0.09*		-0.13**		-0.07*
		(-1.891)		(-2.153)		(-1.686)
RMW			0.03	0.13		0.09
			(0.161)	(0.623)		(0.553)
CMA			-0.33**	-0.13		-0.23
			(-2.169)	(-0.707)		(-1.631)
Distress					0.18*	0.21**
					(1.796)	(2.315)
no. of obs.	120	120	120	120	120	120
Adjusted R^2	17.5%	20.7%	21.6%	22.1%	20.4%	26.2%

The standard errors used in the t-stat calculations are autocorrelation and heteroscedasticity robust. Furthermore *** means that the result is statistically significant at the 1% level, ** at the 5% level and * at the 10% level.

Figures 9 and 10 represent the cumulative returns of the long, short and long/short portfolios with altered portfolio selection criteria. We can see that both the long and short as well as the long/short portfolio returns are of similar scale with each other with some difference in characteristics. We can see that the overall tightened long portfolio produces the highest cumulative returns and the corresponding short portfolio has the highest returns from the short side. We also notice that the returns of the overall tightened long/short portfolio are the highest within this group of portfolios, but its return is the most volatile as well. The average annualized return of these long portfolios are 22 – 27%, where the overall tightened portfolio returns are the highest at 27% and overall loosened portfolio returns are the lowest at 22%. The other long portfolio returns are between 23.6% and 24.5% including the baseline portfolio. Furthermore the short portfolio returns are between 12.5% and 14.6%, where the overall tightened short portfolio return is 14.6% and all the other portfolio returns are between 12.5% and 13.3% including the baseline short portfolio. The long/short portfolio returns are between 4.6% and 6.3% annually, again highest in the overall tightened and lowest in the overall loosened portfolio.

Further in tables 22 and 23 we can see that the Sharpe ratios are quite close to each other with similar portfolios. The long portfolio Sharpe ratios are between 1.22 and 1.47, short portfolio ratios between 0.99 and 1.05 and long/short portfolio ratios between 0.84 and 0.93. Here we notice that the overall tightened long/short portfolio has, even though the highest return, the second lowest Sharpe ratio. This is due to the higher volatility of the portfolio (7.2% compared to 5 – 6% in other portfolios), which is likely due to the low amount of stocks in the portfolio (only 10 in both legs). This low amount of stocks leads to single stocks having a large impact on the overall portfolio return. Furthermore we note that the baseline long/short portfolio Sharpe ratio of 1.06 is the highest within the long/short portfolios. Therefore it seems that larger emphasis on neither value nor distress enhances the current strategy. Again plain optimization could create more value to the strategy, but it could also overfit the data.

Tables 24 – 27 present the OLS regression results for the long/short portfolios with altered screening criteria. All portfolio alphas are mostly significant between 2.4% and 5.7%, but there are some interesting characteristics noticeably different between the portfolios. Firstly it seems that when the value cutoff is loosened, the alphas drop (Tightened Z and loosened overall portfolio alphas between 2.4% and 3.9%, whereas other portfolios between 3.4% and 5.7%). The adjusted R-squared seems to be lower with tighter Altman Z cutoffs (10-20% in tight Altman Z and 20-35% in the loosened Altman Z). It also seems that tightening the Z-score threshold increases the SMB loading and decreases HML loading (0.3 vs. 0.2 loading on SMB and 0 vs. 0.3 loading on HML with the tightened Z and loosened Z portfolios). Furthermore more rigorous value cutoffs increase the negative MOM loading (significant 0.2 in loosened Z and tightened overall, mostly insignificant 0.1 loading in others). Lastly it seems that more rigorous Z-score cutoff decreases the loading on distressed stocks (0.3 in tightened Z, otherwise 0.2).

These results indicate that it is important to have a clear value cutoff between the long and short side portfolios, and furthermore that more rigorous overall portfolio selection increases the raw returns and alphas of the strategy. However we must bear in mind that the small amount of stocks in the overall tightened portfolio might lead to higher volatility and lower Sharpe ratio comparing to portfolios with less rigorous cutoffs. Furthermore it seems that tighter Altman Z thresholds decrease the explanatory power of the traditional factors. It also seems that tightening the Z-score cutoffs moves the factor loading from HML to SMB, which implies that the portfolio returns are likely to be due to size anomaly after the distress risk elimination. Moreover it seems that the more rigorous the value cutoffs, the more the strategy invests against the Momentum strategy and that the more rigorous the Altman Z thresholds, the less the strategy loads on distressed stocks.

6 DISCUSSION

This chapter first discusses the possibility to implement the distress risk eliminated value strategy, mainly the short side of it since it can be considered more difficult. Further the section discusses the implications of the results and compares them with previous literature.

6.1 Implementing the strategy

Implementing the long side strategy sounds quite trivial since these companies (EuroStoxx600) are basically the largest in Europe. Of course with huge investments it could be possible to dry up the whole liquidity in the market from the long side as well, but rather the possibility to short these companies should be considered to be the challenge. To monitor the possibility to short these stocks as well as to see what it costs, the Finnish companies included in the EuroStoxx600 index on 31/12/2018 are used as an example to find out whether shorting these stocks is possible and not too costly. In table 28 below one can see the Finnish companies that that are included in the EuroStoxx600 index on 31/12/2018. The possibility to short all these stocks either via stock lending or liquid derivatives market is investigated.

Table 28: List of Finnish companies included in the EuroStoxx600 on 31/12/2018

Finnish companies
UPM-KYMMENE OY
ELISA CORPORAT
KONE CORPORATI
VALMET CORP.
SAMPO A
ORION B
METSO
WARTSILA B
NOKIAN RENKAAT
KESKO B
FORTUM
AMER SPORTS A
KONECRANES OYJ
NESTE
HUHTAMAKI OYJ
STORA ENSO R
NOKIA

When going through the list of stocks we notice that it includes Amer Sports, which was sold private on 3/2019 and therefore during the time of writing (4/2019) it is no longer possible to short Amer. However, it has been possible to short Amer during 2018, since the author of this study has been short Amer all the way until the end of year 2018.

Appendix I lists the Finnish stocks available for stock lending via Nordnet on 13/3/2019. In this list we can find all the stocks found in the EuroStoxx 600 Finnish companies list excluding Neste and Amer. Appendix I further includes a list of derivatives that create a possibility to short Neste in Nordnet. Here we see that the list is long, and with this many products the available liquidity for shorting seems quite good. When opening one of the products, a certificate with a constant leverage of 2, we can see that the product costs 7.5EUR and there are 15 000 papers available with a bid/ask spread of 0.3%. Other costs of utilizing this product are 1% over the risk free rate (EONIA) annually as an index and leverage fee. Therefore it seems that with only one product it is possible for anyone to short via this market at least with 7.5*15 000*2 = 225kEUR with quite moderate fees. When going through the list there are multiple products for each underlying varying in leverage, issuer, product type etc. but the liquidity of these products is quite similar with each other. Therefore it seems possible to short these stocks via both the derivatives market and stock lending. The other question is whether the cost of shorting is too large to eat up all the profits. Therefore the cost to short these stocks with simple derivatives is discussed below via two examples.

Taking this analysis further, two hypothetical short cases during 2018 are investigated, one in which the short position return is clearly negative (Nokia) and one in which the return is clearly positive (Nokian Renkaat). The returns of these positions are calculated from the Thomson Reuters data without taking into account transaction costs as well as by implementing the short with a bear tracker certificate taking into account the transaction cost, bid-ask spread and index and leverage fee for the products during 2018. The products utilized are BEAR NOKIA X1 NORDNET F and BEAR NRE NF short tracker certificates which just track the short position return without any additional leverage. The bid-ask spread for these products has been at 0.2% during 2018 and the transaction cost is between 0.06% and 0.2% in Nordnet for the usual customer varying on how much one trades. The available liquidity with these bid-ask spreads is at 100kEUR, meaning that a strategy with up to 4mEUR to invest would be sufficed with a single product like this for each of the stocks shorted. With annual rebalancing, the transaction cost would be 0.2% for each trade and with monthly rebalancing 20 stocks long and 20 stocks short the cost would be 0.1% for each trade.

With BEAR NOKIA X1 NORDNET F the return is -34.7% during 2018 including only the index and leverage fee, whereas the same Nokia short return is -34.1% with the Thomson Reuters data without taking into account any transaction costs. Similar figures for BEAR NRE NF and Nokian Renkaat short are +25.0% with the certificate and +25.7% with the Thomson Reuters data. This indicates that the index and leverage fee has been between 0.6% and 0.7% during 2018, which is in line with the products stating that the fee is 1% + EONIA rate. When we add all the costs together we remain with 0.1% (bid) + 0.2% (buy) + 0.6% (Index and leverage) + 0.1% (ask) + 0.2% (sell) = 1.2% cost for the short side and 0.4% for the long side taking into account transaction costs and assuming a zero bid-ask for the long positions. This means an overall fee of 0.8% annually for the whole portfolio with annual rebalancing. For monthly rebalancing the costs would rise to 0.1%*12 (bid) + 0.1%*12 (buy) + 0.6% (Index and leverage) + 0.1%*12 (ask) + 0.1%*12 (sell) = 5.4% annually for the short side and 0.2*12 = 2.4% annually for the long side, adding up to a total cost of 3.9% for the whole strategy. This would practically eat up all the alpha from the strategy with monthly rebalancing.

When looking at the calculations above we must keep in mind that these are list prices for all customers meaning that with reasonable amount of capital both the transaction costs including the bid/ask as well as the index and leverage fee could decrease. One way to look at this is that the plain transaction fee for each deal is the largest single part of the overall fee with these products instead of the product specific fees. This means that a simple long strategy with for example 40 stocks and monthly rebalancing would cost 2.4% annually which can be considered high at least for a large investor considering the amount of trading involved.

As stated previously, one other way to implement the short leg would be stock lending. All these Finnish stocks excluding Neste are available to stock lending in Nordnet, but in this approach neither the amount of stocks available for shorting nor the cost of lending are as transparent as for the derivatives. Further argument for using these derivatives is that margin calls are not an issue with them, whereas with stock lending it is possible that there would be a need to post additional collateral after markets move. However there is one additional risk when using derivatives, and that is counterparty credit risk. In other words there is a risk that the issuer of the derivatives defaults after which the current owner of these products doesn't get paid. This problem can be mitigated with a collateral agreement with the issuer, but these agreements again mean the possibility for margin calls both ways.

Overall it seems that with 12M holding period the costs could be lower than the strategy alpha (0.8% cost vs. 2.5 – 4% alpha annually), but with 1M holding periods the costs would rise at least very close to the alpha (3.9% cost and 4 – 5% alpha annually) with list prices. However, one thing to note here is that we cover list prices available for everyone, and with more trading and more capital available the prices are likely to drop, since the largest single cost with the current price is the fixed transaction fee that is 0.1% at lowest every time when making a trade.

6.2 Implications of the results

Firstly on the overall results during the whole sample period from 2009 – 2018 with 1M holding periods we notice that the rating cutoffs do not seem to work, since the cumulative returns of value long/short portfolio based on ratings are not different from zero. This is in line with Piotroski (2000), who states that all the value that the distress risk measures add come from the operating profitability and efficiency metrics and not from for example leverage. Furthermore we note that both the long and short portfolios of the distress risk eliminated strategy are better than the comparable plain value portfolios measuring by Sharpe ratios. It seems to be equally possible to find distressed glamour stocks to be short than it is to find non-distressed value to be long. Further it seems that shorting these distressed glamour stocks instead of non-distressed glamour enhances the return of the strategy. From the long side these results are in line with Griffin and Lemmon (2002), Vassalou and Xing (2004) and Piotroski (2000). The findings from the short side are new and they imply that it is possible to find overpriced distressed companies to short as well as underpriced non-distressed companies to be long. This result is in line with the mispricing theory of Lakonishok, Shleifer and Vishny (1994) as well as my second and third hypotheses. The regression results imply the same, since the alphas are positive and significant (4-5% annually with FF5, MOM and Distress risk factors) with the distress risk eliminated value long/short portfolio, but not on the plain value portfolio. The alphas are also higher than those of Griffin and Lemmon (2.3% annually) which is likely due to the added short portfolio. Furthermore it seems that the plain value strategy loads on distressed stocks, and the distress risk eliminated value portfolio on non-distressed. This distress risk factor loading is a new result, and it is in line with my first hypothesis and Fama and French (1993) stating that part of the plain value strategy returns can be explained by elevated distress risk of value stocks. The results are also in line with Griffin and Lemmon (2002) who find that distressed stocks include many small cap value stocks as well as they are in line with my second hypothesis and Lakonishok, Shleifer and Vishny (1994), since the value strategy returns can still be found when eliminating distress risk. Additionally we find that the distress risk eliminated value strategy loads significantly on market, SMB and MOM factors (MOM loading negative, others positive), whereas with the plain value strategy also the HML loading is significantly positive. The market, SMB and MOM factor loadings are in line with Agarwal and Taffler (2008), even though they are only considering long portfolios. Lastly we note that the plain distress risk long/short portfolio does not provide returns different from zero. This contradicts with the results of Malik and Aftab (2013) who find distressed companies to overperform, but is in line with Anginer and Yildizhan (2017) who find that on average distress risk is priced correctly in the market.

Secondly from comparing the results with longer holding periods of 3M and 12M we see that the 1M holding period is able to provide the highest and most stable return for both the long and short sides individually as well as for the long/short portfolio. Furthermore we note that the alphas decrease gradually with longer holding periods, though still staying positive for the distress risk eliminated value strategy. The plain value strategy alphas are zero in all models with both 3M and 12M holding periods. The mentioned shorter holding period outperformance might be due to faster reaction to either value signals from the market or to new accounting information with these shorter holding periods. These results add value to Piotroski (2000), Agarwal and Taffler (2008) and Griffin and Lemmon (2002) for example, who only consider 12M holding periods in their studies. Furthermore the results show that the distress risk factor loading increases (as do SMB, HML and MOM loadings) with longer holding periods. This might be due to traditional factors gaining more explanatory power when the reaction to distress signals becomes slower.

Thirdly from comparing the results during 2009 – 2013 and 2014 – 2018 we notice that the distress risk eliminated value strategy works in both highly positive and moderately positive return environments and further that the strategy works even a bit better during the later period. During 2009 – 2013 it seems that the market and SMB portfolios explain the distress risk eliminated value long/short portfolio return quite well. However we notice that during 2014 – 2018 none of the factor portfolios is able to explain the return of the distress risk eliminated value portfolio significantly, and during that period the portfolio yields 4.5 – 6% annual alphas. Looking into figure 4 it seems that the anomalous returns of the distress risk eliminated value portfolio persist even when the traditional factor portfolio returns seem to decrease. These results are well in line with the mispricing theory of Lakonishok, Shleifer and Vishny (1994) and my second hypothesis. However, we must also keep in mind that some of these results might be due to small subsample sizes (only 60 observations during both time periods).

7 CONCLUSION

This paper utilizes data of EuroStoxx600 companies on a time period of 01/2009 – 12/2018 to study whether eliminating distress risk exposure enhances the returns of a value strategy. My hypotheses are that 1. Plain value long portfolio stocks are on average more distressed than those of the plain value short portfolio, 2. Eliminating distress risk exposure enhances the plain value portfolio performance 3. It is possible to find distressed glamour stocks from the market, and these stocks underperform other glamour. The first hypothesis is based on Fama and French (1993) risk-based approach stating that value anomaly returns are due to higher distress risk of value stocks compared to glamour stocks and the second and third hypotheses based on Lakonishok, Shleifer and Vishny (1994) mispricing theory which states that value anomaly returns are due to investor sentiment underpricing value stocks and overpricing glamour. The most important results are that:

1. It is possible to find distressed glamour stocks in the market.
2. These distressed glamour stocks are a better short leg for the non-distressed value strategy than non-distressed glamour stocks are.
3. The performance of the distress risk eliminated value long/short portfolio is high during the whole period, even when the traditional factor portfolios don't perform.

The first two points show that distress risk is not priced correctly in glamour stocks whereas the last point indicates that utilizing this incorrect pricing of distress risk, it is possible to outperform the traditional value long/short portfolios.

More specifically the results show that a distress risk eliminated value long/short portfolio is able to beat the plain value long/short strategy by raw returns (6.0% vs. 3.6% annually), Sharpe ratios (1.06 vs. 0.39) and risk-adjusted returns during the whole time period 2009 - 2018. More specifically they show that the distress risk eliminated value strategy yields 4-5% statistically and economically significant annual alphas, whereas the plain value portfolio alphas remain mostly insignificant. This result is in line with my second hypothesis. Moreover it seems that the plain value portfolio loads on distressed stocks, which further implies that some of the plain value strategy returns are due to increased distress exposure. This is in line with my first hypothesis. Further the results show that both the long (Sharpe ratios 1.39 vs. 1.18) and short (Sharpe ratios 0.96 vs. 1.09) legs of the distress risk eliminated value strategy are able to outperform the same leg of the plain value strategy. This implies that also the short leg with distressed glamour stocks that has not been studied previously adds value to the strategy. It also seems that it is as possible to find distressed glamour stocks as it is to find non-distressed value and that these distressed glamour stocks are a better short leg for the strategy than non-distressed glamour, since both the return is higher (6.0% vs. 2.7%) and the volatility is lower (5.7% vs. 6.3%) with the distressed short leg.

Dividing the data into two separate time periods 2009 – 2013 and 2014 – 2018 shows that the distress risk eliminated value strategy works in both highly positive and moderately positive return environments. Furthermore this analysis shows that the strategy returns persist even though the traditional factor portfolios suffer from decreasing returns, and therefore during 2014 - 2018 the annual alphas have been higher than during 2009 – 2013, between 4.5% and 6% annually during the later period.

Lastly, when comparing different holding periods for the strategy it seems that the 1M holding period provides the highest return comparing with 3M and 12M periods (6% vs. 5% annually). This implies that faster reaction to accounting information or to new indication of value enhances the returns of the strategy. What remains to be studied on the subject is whether the same results also apply during bear markets, and whether it adds value to further optimize the distress risk and value tradeoff for the strategy.

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APPENDIX

Appendix I: Shortable stocks from Finland in Nordnet

Lyhyeksi myytäviä osakkeita

Valuutta EUR

Mikäli haluat lyhyeksi myydä osakkeita, joita ei löydy listalta, otathan yhteyttä asiakaspalveluumme soittamalla numeroon 020 198 5898.
Voit myös lähettää sähköpostia osoitteeseen asiakaspalvelu@nordnet.fi.

Lyhyeksi myytävien osakkeiden listaa päivitetään jatkuvasti. Vaikka osake näkyisi listalla, ei se ole tae osakelainan myöntämiseksi tai takuu etteikö jo myönnettyä osakelainaa voida vaatia takaisin.

Nimi	Tunnus	Vakuusvaatimukset
Aktia Bank Plc	AKTIA	150%
Asiakastieto Group Oyj	ATG1V	160%
Cargotec Oyj	CGCBV	125%
Citycon Oyj	CTY1S	130%
Cramo Oyj	CRA1V	130%
DNA Oyj	DNA	140%
Elisa Corporation	ELISA	115%
Finnair Oyj	FIA1S	150%
Fortum Corporation	FORTUM	115%
Huhtamäki Oyj	HUH1V	125%
KONE Corporation	KNEBV	115%
Kemira Oyj	KEMIRA	125%
Kesko Corporation B	KESKOB	115%
Konecranes Plc	KCR	120%
Lassila & Tikanoja Plc	LAT1V	140%
Metso Corporation	METSO	120%
Metsä Board Oyj B	METSB	130%
Nokia Corporation	NOKIA	130%
Nokian Tyres Plc	NRE1V	120%
Nordea Bank Abp	NDA FI	120%
Olvi Plc A	OLVAS	140%
Oriola Corporation B	OKDBV	150%
Orion Corporation A	ORNAV	130%
Orion Corporation B	ORNBV	120%
Outokumpu Oyj	OUT1V	150%
Outotec Oyj	OTE1V	140%
Ramirent Plc	RAMI	130%
Sampo Plc A	SAMPO	115%
Sanoma Corporation	SAA1V	130%
Stora Enso Oyj R	STERV	125%
Telia Company AB	TELIA1	115%
Terveystalo Plc	TTALO	200%
Tieto Corporation	TIETO	120%
Tikkurila Oyj	TIK1V	130%
Tokmanni Group Oyj	TOKMAN	150%
UPM-Kymmene Corporation	UPM	120%
Uponor Oyj	UPONOR	130%
Valmet Corporation	VALMT	130%
Wärtsilä Corporation	WRT1V	115%

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Appendix I continues, example of Neste derivatives

KOHDE-ETUUS

		Valuutta	+/-	%	Osto	Myynti	Viimeisin	Ylin	Alin	Määrä	Vaihto	Aika
Osta Myy +	Neste Corporation	EUR	-0,42	-0,45%	92,56	92,60	92,58	92,84	92,08	65 001	6 016 657	14:19:45

Yleisnäkymä Tunnusluvut

	Tunnus	Tuotetyyppi	Osto	Myynti	Viimeisin	Määrä	Knock out taso	Lunastushinta	Lunastuspäivä	W/K	Valuutta	Aika
Osta Myy +	B SHRTNES 3 CZ	Unlimited turbo short	1.71	1.72	0.000	0	100,63	100,63		5,00	EUR	14:18:24
Osta Myy +	B SHRTNES 4 CZ	Unlimited turbo short	2.70	2.71	0.000	0	105,64	105,64		5,00	EUR	14:14:37
Osta Myy +	B SHRTNES 6 CZ	Unlimited turbo short	3.68	3.69	0.000	0	110,60	110,60		5,00	EUR	14:19:34
Osta Myy +	B SHRTNES 7 CZ	Unlimited turbo short	4.67	4.68	0.000	0	115,59	115,59		5,00	EUR	14:19:43
Osta Myy +	B SHRTNES 9 CZ	Unlimited turbo short	0.708	0.718	0.000	0	95,62	95,62		5,00	EUR	14:19:56
Osta Myy +	B SHRTNES A CZ	Unlimited turbo short	5.67	5.68	0.000	0	120,60	120,60		5,00	EUR	14:18:49
Osta Myy +	B SHRTNES BC CZB	Unlimited turbo short	0.740	0.750	0.000	0	95,67	95,67		5,00	EUR	14:19:56
Osta Myy +	BEAR NES X4S NORDNET F	Bear-sertifikaatti	1.6500	1.6600	0.0000	0	-	-		1,00	EUR	14:19:56
Osta Myy +	BEAR NES X5S NORDNET F	Bear-sertifikaatti	0.8900	0.9000	0.9000	120	-	-		1,00	EUR	13:44:22
Osta Myy +	BEAR NEST X2 CK	Bear-sertifikaatti	2.52	2.53	0.000	0	-	-		1,00	EUR	14:14:20
Osta Myy +	BEAR NEST X3 CK	Bear-sertifikaatti	0.116	0.120	0.000	0	-	-		1,00	EUR	14:02:14
Osta Myy +	BEAR NEST X3 CK2	Bear-sertifikaatti	1.64	1.65	0.000	0	-	-		1,00	EUR	14:04:28
Osta Myy +	BEAR NEST X4 CK	Bear-sertifikaatti	0.990	1.00	0.000	0	-	-		1,00	EUR	13:44:12
Osta Myy +	BEAR NEST X5 CK	Bear-sertifikaatti	0.001	0.000	0.000	0	-	-		1,00	EUR	10:00:05
Osta Myy +	BEAR NEST X5 CK2	Bear-sertifikaatti	0.001	0.000	0.000	0	-	-		1,00	EUR	10:00:06
Osta Myy +	BEAR NEST X5 CK3	Bear-sertifikaatti	0.553	0.557	0.000	0	-	-		1,00	EUR	14:19:43
Osta Myy +	BEAR NEST X6 CK	Bear-sertifikaatti	0.275	0.279	0.000	0	-	-		1,00	EUR	14:19:43
Osta Myy +	BEAR NESTE X2 NORDNET F	Bear-sertifikaatti	0.4300	0.4400	0.0000	0	-	-		1,00	EUR	13:28:58
Osta Myy +	BEAR NESTE X3 NORDNET F	Bear-sertifikaatti	0.0900	0.1000	0.1000	20000	-	-		1,00	EUR	13:21:38
Osta Myy +	BEAR NESTE X3 S	Bear-sertifikaatti	0.003	0.005	0.000	0	-	-		0,57	EUR	10:03:00
Osta Myy +	BEAR NESTE X3 V	Bear-sertifikaatti	0.187	0.191	0.000	0	-	-		100,00	EUR	14:14:36
Osta Myy +	BEAR NESTE X4 C	Bear-sertifikaatti	0.001	0.000	0.000	0	-	-		1,00	EUR	10:00:05
Osta Myy +	BEAR NESTE X4 CK	Bear-sertifikaatti	0.011	0.000	0.000	0	-	-		1,00	EUR	10:00:06
Osta Myy +	BEAR NESTE X4 S	Bear-sertifikaatti	0.001	0.000	0.000	0	-	-		0,52	EUR	10:03:00
Osta Myy +	BEAR NESTE X5 V	Bear-sertifikaatti	0.003	0.000	0.000	0	-	-		100,00	EUR	10:01:01
Osta Myy +	BEAR NESTE X5 V2	Bear-sertifikaatti	0.288	0.292	0.000	0	-	-		1,00	EUR	14:15:39
Osta Myy +	BEAR NESTEX3 NF2	Bear-sertifikaatti	0.0200	0.0000	0.0000	0	-	-		1,00	EUR	10:00:30
Osta Myy +	BEARNESX2NF	Bear-sertifikaatti	4.5100	4.5400	0.0000	0	-	-		1,00	EUR	14:19:56

https://www.nordnet.fi/mux/web/marknaden/kurslista/warranter.html?flerSokfalt=1&selectedtab=Overview&sortcolumn=shortname&sortorder=ascending&currency=EUR&firstLevelIssuer=&instrument=16102550&market_view=D&instr_group_type=&instr_type=&issuer=&date=&